Interactive Multimedia Learning

Science With Puzzles

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ABSTRACT

Educational innovation occurs in many different ways. One approach use computer technologies to enhance the learning environment. Besides, computer assisted-learning can reduce the anxiety of students and turn out to be a positive side of learning (Gates, 1997)

Children are our future leaders in the coming generation. Hence, Interactive Multimedia Learning Science with Puzzles is an interactive educational learning science with puzzles in English meant for children aged 6 to 9 years old. It comprises of an interesting storytelling with puzzles games, suitable for lower primary school (primary 1-3) for Malaysian children. It is a web based multimedia learning - teaching and can be beneficial teaching tool for parents and teachers in educating the young children because the teaching will follow closely to the KBSR Science syllabus.

Interactive Multimedia Learning Science with Puzzles is developed to promote education in a more fun, easier and relaxing environment for children to learn science. Thus, it will eventually develop their interest in learning new thing. This package comprises storytelling, quiz puzzles, & puzzles games with cartoon animation.

Software that will be used in the development of this Interactive Multimedia science with Puzzles project is Macromedia Flash 5, Adobe Photoshop and Adobe Illustrator. The approach of prototyping model is chosen for developing Interactive Multimedia Learning Science with Puzzles because it is a most widely used model & it is straightforward.

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CHAPTER 1: INTRODUCTION

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1.1 Introduction

Multimedia has been used for a long time in education and training. Nowadays, many software available in an interactive multimedia approach as people can really see the positive outcome of interactive multimedia approach. Edutainment is the combination of education and entertainment. Many multimedia titles, especially children's games fit this category (James E. Shuman, *Multimedia in Action*).

Interactive multimedia approach is seen as a natural way to learn because it involves the student individually through sight, sound, and touch – is necessary. Multimedia application is its interactivity, and this accomplished by linking all of the multimedia components – that is, text graphics, animation, sound, and video – into a cohesive interactive application.

This project aims at developing a web-based multimedia learning-teaching for lower primary school. The approach will be based on learning-teaching science with puzzles. Puzzles according to oxford dictionary mean problem or toy designed to test knowledge or ingenuity. This application will enable children aged between 6 to 9 aged to visit this web site to enjoy learning science with puzzles games that will promote the students interest in learning science. It is easy for the children to access and convenience.

As an educational tool, it is believed children are able to enhance their knowledge absorption and retention rate as well. Besides that, it is developed to enhance a step further the level of learning by listening and

reading together with interesting games include for the children while learning.

The development of this project involves the combination of text, graphics, sound and animation to deliver information in the most effective way. Children can enjoy understanding the short lesson of every category in science and play with the games to keep them entertained, interested, and intellectually stimulated.

1.2 Aim Of The Project

One of the channels for information input is through the brain. The more avenues used to input information to our brain, the easier it is to learn and remember. Human can learn better if sound is added to the text and they can learn even better with the addition of graphics (Pilgrim, 1994).

This project aims to set an effective learning tool for children as part of their traditional education – pencils and papers. Interactivity is also very important to have a more active perception to present information. Interactivity is the key element in defining multimedia where learning can be developed through discovery and exploration. Therefore, this project is able to explore children adjust themselves in learning science with the aid of interactive multimedia computers and the interaction between children and multimedia computers.

As a conclusion, this project aims to give education a step further in learning and teaching for lower primary school in order to prepare them for greater challenge in school. It is an approach to let the children have different view, points and advance methods in the learning process.

This new way of entertaining and fun learning environment will definitely bring a new look to traditional method where parents read to them the facts of science and teachers writing down the facts on a blackboard.

1.3 Objectives

The objectives of developing this Interactive Multimedia Learning Science with Puzzles are as follow: -

- To design and develop a web based multimedia learning and teaching science for lower primary school.
- To design and develop attractive and interactive interfaces application to make this sites user-friendly to students as well as teachers and parents.
- A better way of assisting students in learning science through interactive multimedia approach.
- To help the students to understand science and enjoy learning science. It will help them to develop a better learning skill and brainstorming.
- To give a new approach in education from the traditional method. This can make education fun learning and enjoyable.
- To help the younger generation to be more computer literate.

1.4 Project Scope

This project is developed suitable for people who are: -

- Students from primary one to primary three or aged between 6 to 9 years old. It is mainly designed to educate the students from lower primary schools before they get in touch with science in the upper primary schools.

- Teachers who are teaching lower primary schools. It can be a teaching-tool for the teachers to guide and teach the students in advanced about science.
- Parents with children studying lower primary schools. Parents will help their children to be more intellectual and interest in studies.

The assumptions that are made are: -

- There is a personal computer access to the Internet. It is a web based multimedia learning and teaching application. So it only can be retrieved online.
- Students, parents, and teachers are computer literacy. If one cannot understand how to use a personal computer, it is very hard for them to learn and play the game from this web page.

1.5 Schedule

To achieve this project's objectives, a project schedule is highly needed to plan and schedule the tasks properly according to a certain period of time so that the needed activity that is to be done can be accomplished within the certain time frame. Thus, it will help to systematically organize the project. A Gantt chart is used to schedule tasks.

A Gantt chart is a method used to help define the breakdown of the project into tasks and the sequence of tasks that need to be performed according to a time line.

MONTH	June				July				Aug				Sep				Oct				Nov				Dec				Jan				Feb			
WEEK	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Feasibility Study																																				
Literature Studies																																				
System Analysis																																				
System Design																																				
Coding																																				
Testing & Review																																				
System Documentation																																				
Presentation																																				

Table 1.1: Gantt Chart - starting and ending period for each activity in the project

1.6 Expected Outcome

This project is expected to impart knowledge of science to the children in four different categories. They are the category of flora, fauna, human, and the universe. Besides that, it will give the children a touch of science through interactive multimedia method and be more computer literate. Due to time constraint, the syllabus that will be using for teaching and learning will be very basic as an introduction to the world of science - simplifies from the KBSR Science.

It is also expected that this web-based learning can give a reliable and user-friendly environment so that it can easily handle by the user.

CHAPTER 2: LITERATURE REVIEW

CHAPTER 2: Literature Review

2.1 Introduction

Review of literature is a background study about the knowledge and information gained to develop this project. The purpose of this literature review is to gain a better understanding on the development tools that can be used to develop a project and also get a better knowledge on the development methodologies used while developing a project.

References, related articles and examples of previous theses have been searched and analyzed to understand and recognize the existing interactive multimedia learning and teaching available in the market, current Information System and E-Learning. Investigation and analysis of all these information are very important to ensure the proposed system will be a better system compared to the existing system. It will also avoid repeating and carrying the weaknesses of the existing application to the proposed system.

2.2 The Word "Multimedia"

The word "***multi***" means many meanwhile the word "***media***" (from *medium*) can be define tools that are used to convey information or as a means of communication. When it combines together, multimedia is a method of conveying information to people in many ways through interactive. This definition applies to interactive media productions for distribution both online, such as Web pages, and offline, such as kiosks and CD-ROM.

2.3 Introduction To Multimedia

The word multimedia has been used by different industries to mean different things. Technically, the terms refer to the use of more than one medium to convey information. Multimedia plays an important role in conveying information to people in nowadays society, especially in learning or education.

Multimedia is the seamless integration of text, sound, images of all kinds and control software within a single digital information environment (Tony Feldman, *multimedia consultant*).

Various media types, such as graphics, photos, animation, sound, video & text are valuables, if not essential aids in teaching. When these are integrated into an interactive format on a PC they constitute multimedia, providing a rich learning environment for learners (Levin, 1993).

Enter "multimedia", another technology that promised to change the way we use our computers. It's interesting how skeptical many were at first encountering multimedia, probably as a result of the perceived letdown of Artificial Intelligence (AI) technology. Fortunately, most grasped its implications almost immediately. And for a very good reason – even a four-year-old child can understand it. There is no need to explain how it can benefit (or entertain) the user - the user can see it and, in some sense, feel it.

Multimedia is, in fact, the technology that made people feel as if they are interacting with their computers. Like a conversation with another person, interactive software allows you to lead the conversation into different directions, and if you do not understand something, you can interrupt and

ask for more information (which may be "spoken" to you by the computer) or ask to see a picture. This element of guidance and interactivity is very appealing.

2.4 Why Multimedia Learning Style

Multimedia learning is "*A Breakthrough in Education*". Multimedia can accommodate different learning styles. Some students learn better through association, others by experimentation; some are more visually oriented and others are more auditory. Multimedia can present material in the way we think – in a manner that is nonlinear. It let us review specific aspects as often as we like, skipping around as necessary. It is motivating, as it allow the user to take charge of his or her learning. Multimedia can provide feedback, adjust the level of difficulty, and evaluate skills. And it can make learning fun. (James E. Schuman, *Multimedia in Action*).

2.4.1 Elements Of Multimedia

Multimedia has the ability for the user to interact with the program. Multimedia allows the content to be presented in a nonlinear way, with the use being active rather than passive. Thus, it is interactive, where the user determines what content is delivered, when it is delivered, and how it is delivered (James E. Schuman, *Multimedia in Action*).

- **Text** – Text Is the basic element of most multimedia titles. Text is of concern to the developer from two main standpoints. The first is the way in which text is presented to the user: it should be easy to read, well-designed and short text. This involves the consideration of font, color, and text size. The second main concern of the developer is

what lies behind the text: that is, the interactive "links" that the user does not see but can activate to get to additional information.

- **Graphics** – Graphics may include a drawing, a high-resolution photograph, or an icon. Graphics are perhaps the most important aspect of a multimedia title because they provide a great deal of information at a relatively low "cost" in terms of required storage. Graphics may also serve as hyperlinks to other types of information.

- **Animation and Morphing** – An animated sequence is a set of graphic images that may be displayed quickly as a series of frames or a set of objects / "characters". Morphing is a type of animation in which interpolations between specified points on two or more images are used to create a transitional effect, such as the image of a cat changing into a dog.

- **Sound** – Sound may include a narrative, music, or special effects and, when properly integrated, greatly enhances a multimedia application. For example, a narration is a useful accompaniment to an animation to explain what is happening while the user is viewing the animation.

- **Video** – Nowadays, due to falling hardware prices, larger storage capacities, and more advanced data compression techniques, video is increasingly commonplace. In fact, video playback capabilities are becoming standard on most new PCs that come with Windows.

- **Interactivity** – The real key to an effective and successful multimedia title is its interactive design, which allows the user to "navigate" through

the program any way that he or she chooses. This is what makes the program feel more personal to the user.

2.5 Advantages Of Multimedia

There are many advantages why choosing multimedia way of learning been applied in this project: -

- Through many researches and thorough analysis by wide range of people, multimedia proves as mirrors the way in which the human mind thinks, learns and remembers by moving easily from words to images to sound, stopping along the way for interpretation, analysis, and in-depth exploration.

- Multimedia has a chameleon-like ability to pretend to be many things. In designing an application you have the freedom to use many disparate media types and techniques.

- The combination of media elements in a multimedia lesson enables children to learn more spontaneously and naturally, using any sensory modes they prefer. For instance, they are people who can learn better through seeing, others may find it easier to learn through seeing and hearing, still others learn best through manipulation kinesthetic (tactile) exercises.

- By combining all the media elements with well-designed, interactive exercises enables learners to enhance their learning and experience through self-discovering. This will enable them no longer passive while information is "spoon-feeding" to them.

- Programs that are designed sometimes do allow feedback in order to clarify misconceptions before trainees become confused and to provide direct reinforcement for correct responses. As you can see, this will enable them to be more analytical and active in learning.

- Putting the words with pictures, graphics, and audio, multimedia programs enable people with varying levels of literacy to learn by using sight, hearing, and touch. Evidence proves that using multimedia segments as context for students significantly aids in reading comprehension.

- Looking back, students from the pass may only raise their hands to ask a question so many times. But now, many multimedia programs (expert system) are designed to allow learners to pause, branch, or stop for further remediation, exploration, or enhancement opportunity. These interactive qualities encourage non-linear thinking.

- With a multimedia program, learners can get more individualized attention from their teacher, as they need it most.

- Teachers now have more time to focus on activities that demand participation while students are able to learn on their own.

Furthermore, from the results of survey done by other people states that more than 80% get their information by sight, of which 20% is remembered. Meanwhile 11% receive information through hearing of which 30% is remembered. Only 3.5% by smell and 1.5% by touch and taste. As a conclusion, 50% of what is both seen and heard is

remembered and 80% of what is seen, heard, and done is remembered.

2.6 Disadvantages Of Multimedia

Of course, everything in this world has their pros and cons. Multimedia also has it own disadvantages. Below are some of recognized disadvantages of multimedia: -

- To run a multimedia, you need high processor speed, memory, disk space, and data throughput.

- The elements like sound, images or animation, and video require higher bandwidth than text files because of the size.

- The disciplines of multimedia are as diverse as the media types. Familiarity and expertise are required in all facets of facility with computer software.

2.7 Benefit Of Web-Based Learning

There are many sites that are available suitable for children to learn and visit to. One of the major advantages web-based learning is that the users can have 24 hours access to it. It has no time constraint for the user to access in. This give the benefit for the users as they are able to work at their own pace. Unlike in the school, students have to catch up with the syllabuses, as the teachers cannot afford to wait for all theirs students to understand the syllabus before they proceed on.

Besides that, web-based learning allows users to access to the web anywhere – at the school's lab, at the student's dorm, at house, or even at

the cyber-cafe. It only requires users to have personal computer that have the access to the net.

Not only that, most of the web-based learning sites are more interactive and rich in content. The web pages have the elements of video, animation, color, graphics and sound, which can really attract users to be more effective in their learning.

2.8 Introduction To Interactive Multimedia Learning Science With Puzzles

Puzzle as define is question difficult to answer or problem that are difficult to solve. It is a problem or toy designed to test knowledge or ingenuity. Thus, this will cause one need to think hard, or use hard thought to solve this.

Many software application and web-based learning have used this method - puzzles - to attract people to think more and be more interested in learning things. Through passed success and statistic, it does prove that through interactive multimedia learning in puzzles shows great improvement in one skills of learning and understanding.

2.9 Findings

All information gathered for this Interactive Multimedia Learning Science With Puzzles can be divided into printed resources and electronic resources. Printed resources are inclusive of books, magazines and newspapers while electronics resources include sites, which are found using specific keywords on the Internet, or existing software application in the market.

2.9.1 Development Models

Developing a software system is usually not done in a single night of hard work, but is a complex and time-consuming process. In order to control this process, reducing the complexity and uncertainties surrounding the to be software system, trying to adhere to some kind of framework that introduces certain degrees of structure to the overall development process.

Software engineering methodologies are the framework that tells how it should go about developing our software systems. These frameworks define different phases of the development process, such as planning, requirements analysis, design, testing and maintenance.

The most popular methodologies for software engineering are sometimes referred to as software engineering paradigms. The choice of which methodology to use in a development project is closely related to the size of the software system and the environment it is supposed to function in. The environment in itself constitutes a larger system -- though most often not a computer software system, but rather some kind of organization.

The two most widely used life-cycle models / paradigm are the waterfall model and the prototyping model. Thus, these two paradigms were chosen and studied.

a) Waterfall Model

Like any other commercial product, software has a life cycle associated with it. Many models of the software life cycle have been proposed. The most straightforward is the *waterfall model* where the output from each development stage "flows" as input into the next stage. The result can be envisaged as a series of waterfalls hence

the term "waterfall" model. Although the waterfall model over simplifies the process it provides a convenient framework to facilitate discussion of the "art" of software engineering.

Below are the activities occurred during the waterfall life cycle paradigm: -

- **Requirements analysis and definition.**

  The system's services, constraints and goals are established by consultation with the customers and users. These are then defined in a manner, which is understandable, by both customers/users and development staff.

- **Specification Phase.**

  From the requirements, a specifications document is produced which states exactly *what* the product is to do (but not *how* it will be done).

- **System and Software Design.**

  The systems design process partitions the requirements to either hardware or software systems. Software design is actually a multi-step process the focuses on four distinct attributes of a program: data structure, software architecture, interface representations, and procedural (algorithmic) detail. In contrast to the specifications document that specifies *what* requirements will be met, the design documents contain representations that describe *how* the product will meet them.

- **Implementation and unit testing**.

During this stage, the software design is realized as a set of programs or modules. Unit testing involves verifying that each unit meets its specification.

- **Integration and system testing**.

The individual program units are integrated and tested as a complete system to ensure that the software requirements have been met.

- **Acceptance testing**.

The purpose of acceptance testing is for the client to determine whether the product satisfies its specifications as claimed by the developer. During acceptance testing, the product is evaluated for its correctness, robustness, performance, and documentation.

- **Operations and maintenance.**

The operations and maintenance phase involves is the re-application of each of the preceding activities for existing software. The re-application may be required to correct an error in the original software, to adapt the software to changes in its external environment (e.g., new hardware, operating system), or to provide enhancement to function or performance requested by the customer. This is generally the longest life-cycle phase. Below is the flow for waterfall model: -

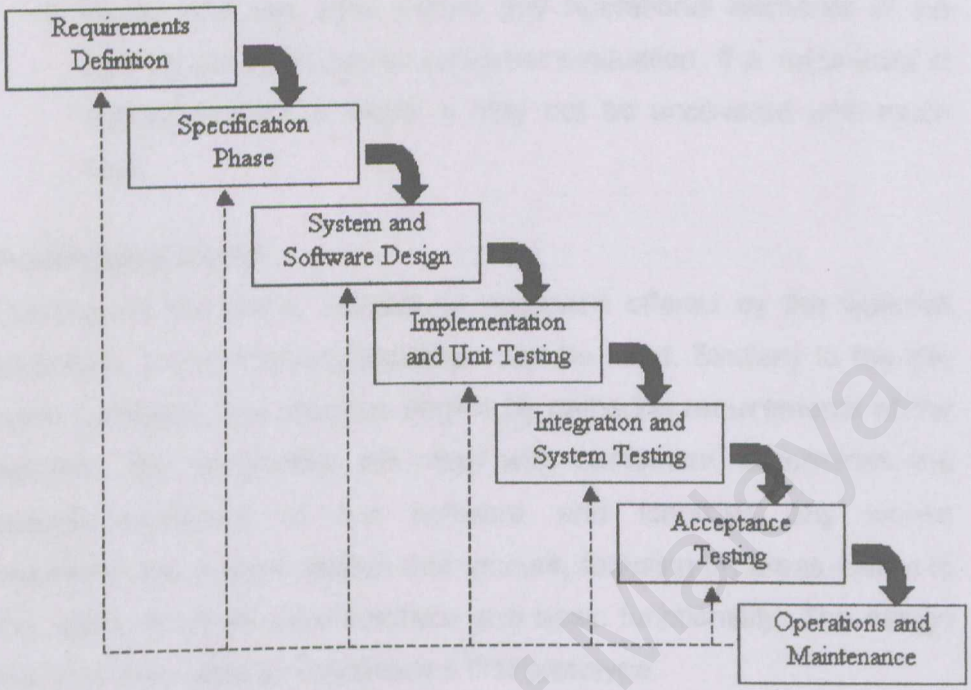


Figure 2.1: The Waterfall Model

The waterfall model is the most widely used in software engineering. It leads to systematic, rational software development, but like any generic model, the life cycle paradigm can be problematic for the following reasons:

1. The rigid sequential flow of the model is rarely encountered in real life. Iteration can occur causing the sequence of steps to become muddled.
2. It is often difficult for the customer to provide a detailed specification of what is required early in the process. Yet this model requires a definite specification as a necessary building block for subsequent steps.

3. Much time can pass before any operational elements of the system are available for customer evaluation. If a major error in implementation is made, it may not be uncovered until much later.

b) Prototyping Model

Contrary to the static, procedural approach offered by the waterfall paradigm, the prototyping paradigm can be used. Similarly to the life-cycle paradigm, this process begins by gathering requirements of the system. The developers will meet with customers, determines the overall objectives of the software and identifies any known requirements. A quick design then occurs, focusing on areas visible to the users, such as user interface and basic functionality. The design model is then used to implement a first prototype.

When the prototype is created, the customer reviews it. Typically this review gives feedback to the developers that help remove uncertainties in the requirements of the software system, and starts an iteration of refinement in order to further clarify requirements by improving the prototype, or by building new prototypes.

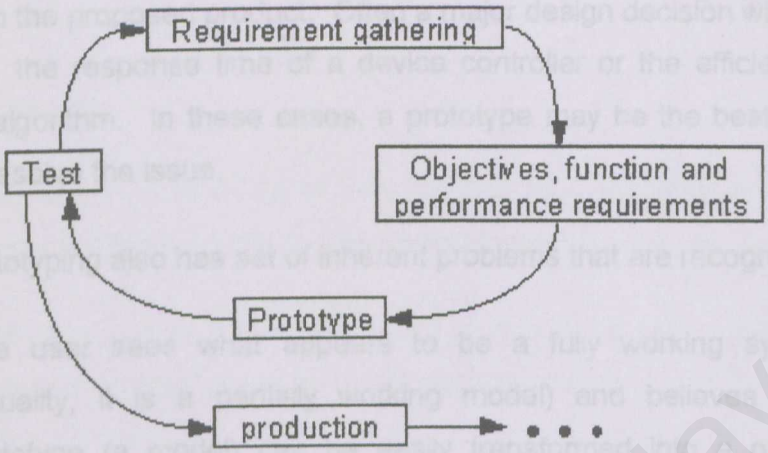


Figure 2.2: The Prototyping Model

The process of developing and using the prototype has five characteristics:

- The prototype is alive, working application.
- The purpose of prototyping is to rest out assumptions made by analysts and users about required system features.
- Prototypes are created quickly.
- Prototypes evolve through an iterative process.
- Prototypes are relatively in expensive to build.

There are several reasons for developing a prototype. One important reason is to illustrate input data formats, messages, reports, and interactive dialogues for the customer. This is a valuable mechanism for explaining various processing options to the customer and for gaining better understanding of the customer's needs.

The second reason for implementing a prototype is to explore technical issues in the proposed product. Often a major design decision will depend on, say, the response time of a device controller or the efficiency of a sorting algorithm. In these cases, a prototype may be the best, or only, way to resolve the issue.

But, prototyping also has set of inherent problems that are recognized:

- The user sees what appears to be a fully working system (in actuality, it is a partially working model) and believes that the prototype (a model) can be easily transformed into a production system. This is rarely the case. Yet many users have pressured developers into releasing prototypes for production use that have been unreliable, and worse, virtually un-maintainable.
- The developer often makes technical compromises to build a "quick and dirty" model. Sometimes these compromises are propagated into the production system, resulting in implementation and maintenance problems.
- Prototyping is applicable only to a limited class of problems. In general, a prototype is valuable when heavy human-machine interaction occurs, when complex output is to be produced or when new or untested algorithms are to be applied. It is far less beneficial for large, batch-oriented processing or embedded process control applications.

2.9.2 Software Development Tools

There are a many good software development tools available in the market. Many of these authoring tools have their own strengths and weaknesses. Studies have been done on few authoring tool, either

though web sites or printed resources. Below are the results of the research.

a. Authorware

Authorware is an excellent content-creation tool, animation and special effects capabilities. It has a powerful scripting.

On the other hands, it requires strong programming skills. It also need third-party package for student tracking and course.

b. Corel WordPerfect Suite

Corel WordPerfect Suite has a full graphic and photographic editing capability, which includes GIF, transparent GIF & JPEG with presentation and PhotoHouse.

However, Corel WordPerfect Suite is less web-style shipping graphics than Word.

c. Macromedia Director 8.0

Director contains a vast selection of resources and features. Director has a very comprehensive package.

Building from Director can be quite expensive. Furthermore, with its numerous features, it may confuse users and likely needed adult guidance.

d. Microsoft Front Page

Microsoft Front Page is considered an excellent support for managing multi-author websites.

It is not easy to learn Microsoft Front Page. It has to be used with caution since a mini web server must be active on the computer to access most functions beyond page layout.

e. Microsoft Publisher

Microsoft Publisher provides extensive support for the automated creation of visually sophisticated websites.

But, the HTML created is rather quirky, so it is advisable not to plan editing pages, which are created with Microsoft Publisher using any other product.

f. Netscape Compose

There is a composer available for (and nearly identical on) PC and Mac Platforms. However, there is no direct import feature. Instead, it requires opening multiple composer windows and cut/paste items from one window into another.

g. HTML

Without HTML, the World Wide Web wouldn't exist. HTML allows the individual elements on the Web to be brought together and presented as a collection. HTML isn't the only way to present information on the Web, but it's the glue that holds everything together. In addition to being a markup language for displaying text, images, and multimedia, HTML provides instructions to Web browsers in order to control how documents are viewed and how they relate to each other.

The users can add many functions inside HTML. They can add their own VBScript and also JavaScript inside HTML to make it become a

dynamic HTML. Besides displaying information, they can show database record in the Internet and get response from other users.

HTML files are interpreted:

1. A web author writes a page composed of pure HTML, and saves it within an .htm file.
2. Sometime later, a user types a page request into the browser, and the request is passed from the browser to the web server.
3. The web server locates the .htm page.
4. The web server sends the HTML steam back across the network to the browser.
5. The browser processes the HTM and displays the page.

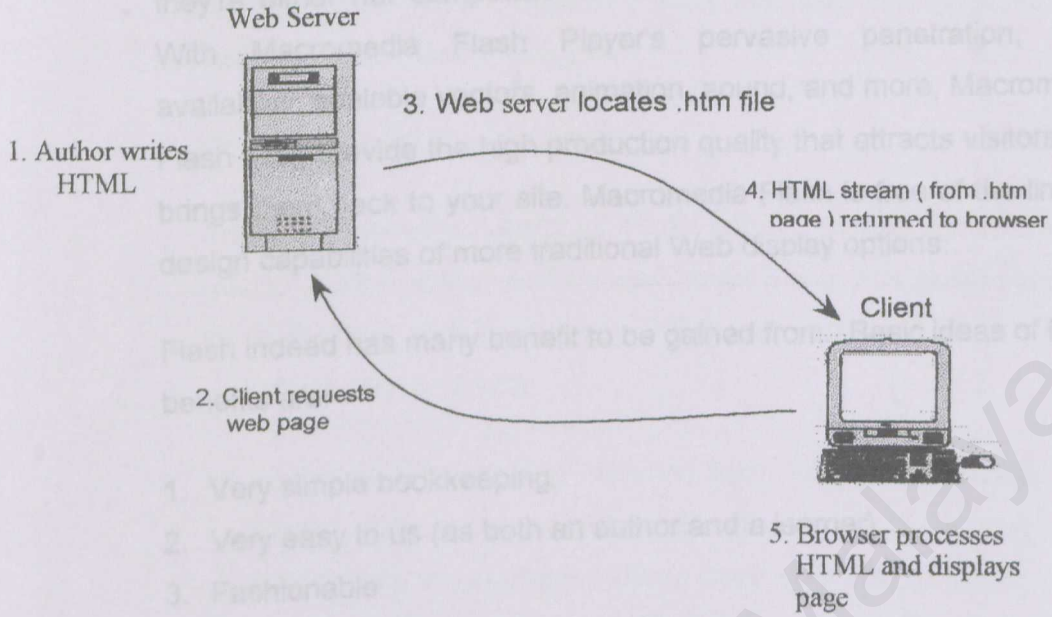


Figure 2.3: How HTML files are interpreted

h. Macromedia Dreamweaver

Dreamweaver provides a good set of tools for web development. Dreamweaver capabilities may be a bit overwhelming for the beginning, but once grasps the assertion organization it is a powerful application. The basic and advanced tools are integrated making the user feel overwhelmed at times.

i. Macromedia Flash 5.0

Macromedia Flash allows you to create a Web experience that is more attractive, more compelling, and compatible with more browsers than with any other Web solution. Dynamic HTML (DHTML), Java, and other advanced Web design formats are not reliable alternatives, since

they're either not compatible or inconsistent with different browsers. With Macromedia Flash Player's pervasive penetration, wide availability, scalable vectors, animation, sound, and more, Macromedia Flash sites provide the high production quality that attracts visitors and brings them back to your site. Macromedia Flash is free of the limiting design capabilities of more traditional Web display options.

Flash indeed has many benefit to be gained from. Basic ideas of Flash benefits are: -

1. Very simple bookkeeping.
2. Very easy to us (as both an author and a learner).
3. Fashionable.
4. Attractive to students.
5. Cross-platform.
6. Suitable for accessing resources and various media.
7. Ideally suited for remote learning.
8. Interlinking providing access to resources held in other subject areas and institutions.
9. Suited to increasing collaborative work and cross-institution communication.
10. Cheap in all aspects of costs.

Flash is the standard for interactive vector graphics and animation for the web. Web designers use Flash to create beautiful, resizable, and extremely compact navigation interfaces, technical illustrations, long-form animations, and other dazzling effects for their sites. Graphics and animation will anti-alias and scale based on the viewer's screen size, providing high-quality viewing. The advantages of flash can be

looked into three major categories, the capabilities of the technology, the player ubiquity, and tool support.

1. Capabilities Of The Technology

From a technology standpoint, Flash offers a unique combination of quality, performance, and compactness along with built-in support for animation and interactivity. The key attributes of the Flash technology are as follow:

- **Fast:** The rendered in Flash has been optimized to deliver anti-aliases static and animated vector graphics to the screen faster than traditional graphics engines draw aliases graphics.
- **Compact:** The Flash vector format is a binary format designed from the outset to be as compact as possible to minimize network bandwidth requirements. Flash files are extremely small, even when animations play back full-screen. In addition, Flash includes support for streaming, which means Flash files can play while they download. There's no wait...even over slow modem connections.
- **Beautiful:** Designed as a display format, Flash features support anti-aliases text and graphics, meaning that all letter and images edge are smooth, even while animating. Furthermore, Flash includes support for graduated fills and transparency, which are essential for the creation of distinct, high impact graphics.
- **Interactive:** Flash is the premier technology for creating multimedia interfaces for the web. Features button object, an event-handling model (mouse up, mouse down, mouse over, etc and a built-in set of actions (get URL, load URL, stop, play, and

go to frame, etc). Together these features give user interface designers tremendous flexibility in the creation of highly interactive user interfaces.

- **Platform Independent:** In addition to the inherent device independence offered by a vector format, Flash is uniquely capable of outputting fully self-contained platform-independent files without any dependence on external resources such as fonts.
- **Animation Support:** Flash support timeliness, which enable the creation of both simple and complex path and sprite-based animation sequences. Using the Flash authoring tool, animators can create everything from flying logos and headlines to full-blown streaming cartoon animations.
- **Bitmap support:** Flash features support for both JPEG and PNG images, enabling authors to include bitmap elements within their Flash based content. Flash also supports bitmap interpolation/smoothing to retain quality when an image is scaled or rotated.
- **Audio support:** The Flash file format supports the inclusion of AIFF and WAV audio samples. Taking advantage of the audio capability, designers can accent their user interfaces designs and include audio tracks in their animation sequences.
- **Extensible:** The Flash file format is a tagged format, a characteristic that will permit Macromedia and the community of platform vendors and tool developers who support the open format to add new capabilities for future versions of the player and authoring tool, while maintaining backwards compatibility with older players.

2. Player Ubiquity

The opportunity for Flash developers is defined by the size of the installed base of PC browsers and Internet devices that include a Flash player. Macromedia has done an outstanding job of ensuring that Flash has the largest installed base possible and is available across the broadest range of Internet platforms possible.

a. **Compact, Portable and Fast Player:** The Flash player has been designed to be as small and portable as possible to ensure rapid proliferation across a broad range of browser/OS platform. The average size of the Flash download package is 100K. The performance of the Flash player has also been optimized for the rapid display of both static and animated images.

   The Flash Player currently ships with all major Web browsers and operating systems (including Netscape Navigator 4.0.6 and higher, Windows 98, Internet Explorer 4 and 5, AOL 4, Mac OS 8 and above, Real Player G2, Web TV, and all Liberate Technologies set top boxes) making Flash the most viewable rich media format on the Internet. According to a recent study by research firm King, Brown, & Partners, the Flash Player is installed in more than 100 million Web browsers, with 77 percent of Web consumers currently able to view Flash content without needing to download a plug-in.

b. **PC Browser Support:** Flash is available for personal computers across the full range of leading PC browsers. The Netscape plug-in works with Netscape 2 or later (Macintosh and Windows) and is shipped as a standard component of the

communicator 4.0 retail product. ActiveX control works with Microsoft Internet Explorer3 or later (Windows 95 or later and is shipped standard with the Internet Explorer retail product, as well as the retail version of Windows 95. Besides, Flash Player Java Edition runs on any Java1.1 or later enabled browser offering content developers an option that eliminates the need for users to download and install a plug-in or ActiveX Control.

3. Tool Support

Critical to the success of any technology aimed at creative professionals is a quality of the tools support, and Flash is no exception. The Flash authoring tool provides graphics and UI designers, as well as animators, an easy-to-use, flexible and powerful environment within which they can create professional – quality vector graphics and animation. Below includes the Flash authoring tool: -

a. **Built-in Drawing/Editing Capabilities:** The Flash tool features a complete collection of drawing and editing tools for sketching or precision drawing. In addition, designers can import and edit images from high-end illustration programs such as FreeHand.
b. **Simple Layout and Composition:** Flash features a movie window consisting of an editor, in which a designer can view the contents of the current movie frame, and a timeline that displays information about the movie over a range of frames. Working within the movie window, designers can quickly and easily arrange both static graphics and animations.

c. **Built-in Support for Interactivity:** Flash supports buttons and a simple set of actions (get URL, goto, play, etc) that enable authors to use Flash for user interface design.

d. **Multimedia Support:** Despite being a vector-based tool, Flash also enables designers to integrate bitmap images and audio into their Flash content. They can stretch, skew, rotate, erase, tint, and brighten imported bitmaps and incorporate synchronized WAV or AIFF sounds into their movies.

2.9.3 Electronic Resources

With browsing the Internet, some of the similarly multimedia learning packages are found. Besides that, available software in the market also have been searched and observed. These found packages are useful since it can be used as main resources for reforming any ambiguities that arise during the process of developing. Besides, multimedia learning packages, journals and feedback web pages that can be of help in analyzing the success of this project are also being considered.

- **URL: http://www.crpuzzles.com**

  This is an on-line puzzle magazine web page. This site give me a better understanding on types of games puzzles available and its creative way of designing variety type of puzzles. There all together 13 types of puzzles can be found, such as criss-cross, word search, crypto list, morph words, etc. The web sites here have the specialty where different puzzles actually meet and suitable for different age. It gave me an idea of designing puzzles in my system.

- **URL: http://www.thinks.com/puzzles**

This site also provides a lot of different types puzzles game that really require deep thinking and analyze. It is a daily puzzle site consists of three categories, the Daily Jigsaw Puzzle, the Daily Crossword Puzzle, and the Daily Word Search Puzzle. It has games like the mastermind where the participate have to guess what is the hidden answer by the computer, and the Tower of Hanoi one of the most popular mathematical puzzle.

- **URL: http://www.cut-the-knot.com/content.html**

It a web page of Interactive Mathematic Miscellany and Puzzles. Raymond Smullyan who is a Mathematician, philosopher and author of several outstanding books of logical puzzles originates this site. As, I was reading his journal, he had said that his desire to put mathematic in education into technology (such as multimedia interactive learning or mathematic in puzzle & games). He also said that later, children might be studying at home through on-line. For him, to start this new technology approach in mathematics it really requires great motivation but somehow it depends on the prevailing culture. In his point of view, differences in personal abilities affect both the process and the end result of education.

As information technology is subsumed into the greater culture, it becomes more transparent, viewed simply as an implement to foster human achievement and communication. Technology in the classroom should play a similar role: as an everyday tool that empowers students to explore and master important ideas and to develop valuable personal traits (Raymond Smullyan).

One of the great inspirations given to me about educating using computers is that it can really reform education into a new and more effective approach than the tradition way.

As I browsed the games in solving the puzzles, it really amazed me. For example, the "3 Glass Puzzle", it requires one to think how to move and put the balls into three rows with different height equally. The other one is the "Round Solitaire" is how to move the circle so that all the circles in the ring can be removed.

- **URL: http://www.iste.org/publishing/jrce/Vol28/issue3.html**

This is a journal web page. It is a journal of research on computing in education. Lecturers from different universities and colleges gave feedback on the effectiveness learning with computers.

One of the results in their research is that learning using computer technology can actually improve their students GPA than tradition way of teaching. Besides that, the teachers and the students also gave a positive attitude and respond about computer learning. This proved that more and more people prefer the new way of learning and it does improve and give a positive impact in their studies.

Studying using computers can even motivate the students to go further in their studies. It is proven that the student catch-up easily and they can even play the puzzles games that are available in a little while. This proves through the studies that it gave a positive effect in motivation and achievement

Animation and interactive gave even better result compares to text only learning. A study proves that, those students who are grouped under

animation learning scored 21% and 35% higher than the text & graphics groups. It is concluded that when animation is used to present content and is directly related to the objectives of learning, substantial gains in learning are possible, and students like it better than textual presentations or learning.

- **URL: http://www.learningplanet.com**

This site has very interesting activities for different grades of students. The activities are divided into three grades a) preschool-K, b) Grades 1-3, and c) Grades 4-6 (& up). The puzzles solving that are available are very suitable and easy enough for the students to play along. It created in the sense games to solve. It is interactive with all the multimedia features. But, it does not has an educational site where the students first being educated first before letting the students to solve the puzzles. So, for instance if it ask about the animal in Australia, the students have to know in advance the popular animals in Australia e.g. koala bears, kangaroo etc.

- **URL: http://www.funschool.com/current/games/**

This is one of my favorites sites to explore and analyze in interactive learning for children. The creative and beautiful features in designing puzzles games really inspired me. The designed games are very fresh and creative than others sites that I have visited.

For example, the use of the fairy-tale story "3 pigs & 1 wolf" as a story to solve puzzles. Another one is the "Anagram Sleuth" which solved puzzles like a detective way where the children have to think and analyze a bit before getting the right answer. Another game is the "Dungeon Rescue", where a prince has to rescue his princess, but

before he succeed he has to pass through different stages of question that are been asked and he need to "fight" for it.

This site really can motivate the children to learn and as well improve in their basic knowledge. As it really give the children a fun time in learning besides exploring in educating and to be more computer literate. However, it kept no scores of the student's achievement and no interactive / narrative educating site.

CHAPTER 3: METHODOLOGY & SYSTEM ANALYSIS

CHAPTER 3: Methodology & System Analysis

3.1 Introduction

A methodology encompasses the method used to develop a system. It is a collection of procedures, techniques, tools and documentation aids which helps system developers in their task of implementing a new information system.

Interactive Multimedia Learning is developed using the approach of prototyping. The emphasis is on trying out ideas and providing assumptions about the requirements, as well as the feasibility of the suggested system. There are a few reasons why this approach is adopted.

Firstly, an interactive multimedia learning package has a relatively small amount of background processing and these systems tend to emphasize on the user interface and data flow within the program. Thus, a prototyping approach would best suit the development of such a system.

Besides that, experiments may be carried out to determine the appropriateness of various design approaches and ideas. Prototyping approach allows changes to made and reviewing to be done throughout the development of the system.

Thirdly, prototyping provides a tangible system to work with instead of abstract specification that may be difficult to imagine and visualize. This provides the developer with useful feedback before too much time and effort is wasted on screen design and concepts that will not work successfully.

As for iteration, it is an in integral features of the prototyping approach. Through iteration, the development stages of design, implementation, and evaluation are performed not just once, but as many times as necessary in the given time frame for development. This increases the likelihood that the final product will be of high quality.

3.2 An Introduction - Prototyping Model

A prototype is a partially developed product that enables customers and developers to examine some aspect of proposed systems and decide if it is suitable or appropriate for the finished product. On other words, prototyping means building a small version of a system, usually with limited functionality that can be used to help the user or customer identify the key requirements of a system and demonstrate feasibility of a design or approach.

Since the prototyping model allows all or part of a system to be constructed quickly to understand or clarify issues, it has the same objective as an engineering prototype, where requirements or design require repeated investigation to ensure that the developer, user, and customer have a common understanding both of what is needed and what is proposed. One or more of the loops for prototyping requirements, design, or the system may be eliminated, depending on the goals of the prototyping. However, the overall goal remains the same: reducing risk and uncertainty in development (Pfleeger, 2001).

Prototyping is an information-gathering technique for gathering quickly the specific information about user's information requirements. The prototype

system is actually an operational portion of the eventual system that will be built. It is not a complete system, only some essential functions will be included in the model.

3.2.1 The Prototyping Model

Below is the prototyping model which consists of several steps: -

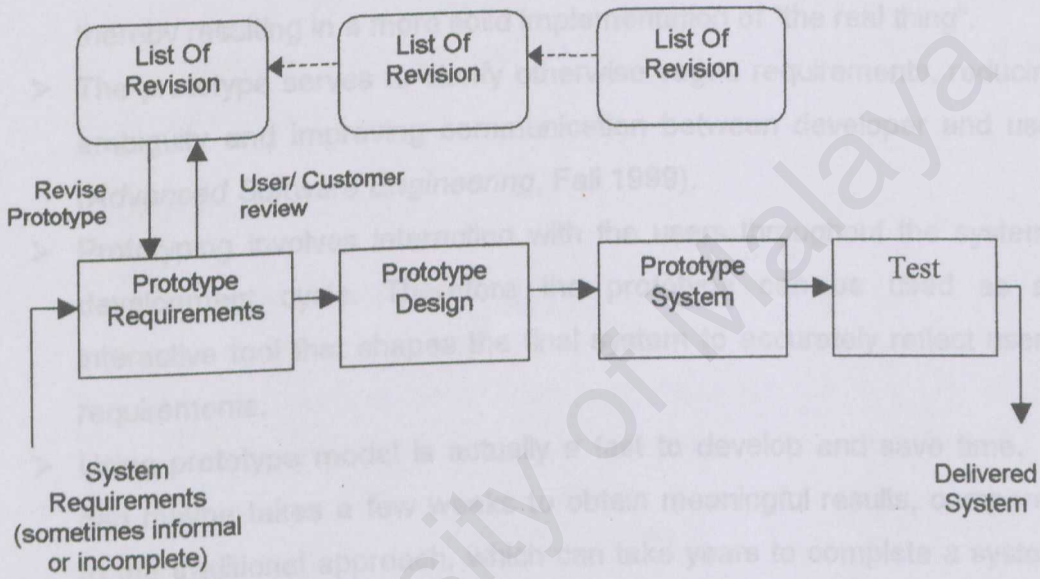


Figure 3.1: Prototyping Model

Like all approaches in software development, prototype begins with requirement gathering. After identifying the known requirement, prototype design is then formulated. The design focuses on top-level architecture and data designs issues rather than on detail procedural design. Then, from the design, a system is constructed. The prototype will then be tested and evaluated to refine the requirements. It is a process of iteration

and occurs until all requirements are formalized or until the prototype has evolved into a product system.

3.2.2 Advantages Of Using Prototype

- A working model is provided to the customer/user early in the process, enabling early assessment and bolstering confidence.
- The developer gains experience and insight by building the model, thereby resulting in a more solid implementation of "the real thing".
- The prototype serves to clarify otherwise vague requirements, reducing ambiguity and improving communication between developer and user (*Advanced Software Engineering*, Fall 1999).
- Prototyping involves interaction with the users throughout the systems development cycle. Therefore the prototype can be used as an interactive tool that shapes the final system to accurately reflect user's requirements.
- Using prototype model is actually a fast to develop and save time. It can maybe takes a few weeks to obtain meaningful results, compared to the traditional approach, which can take years to complete a system to be in operation.
- Besides, prototyping also allows more opportunity for changes. With prototyping, the user can see and work with the outputs from each subsystem or component as it is being developed, enabling the user to suggest changes during the development process (Shelly, Cashman, Adamski & Adamski, 1991).

3.2.3 Prototyping Requirements

There are times when we are uncertain of exactly what is required or needed. The Requirements Analysis may yield a "wish list" of what the

what the users would like to see, but it is unclear whether the list is complete. In other cases, users know what is needed and their wants, but we are not certain whether the users' problem has a feasible solution. There are two approaches to prototyping: -

a) **Throw-away prototype**

A throw-away prototype is a software developed to learn more about problem or explore the feasibility or desirability of possible solutions. It is exploratory and not intended to be used as an actual part of the delivered software.

b) **Evolutionary Prototype**

An evolutionary prototype is developed to learn about the existing problems and form the basis for some or all the developed software. For instance, several evolutionary prototype can be built to let the users - who are not certain about what they want – to choose the preferable options. Once an interface is chosen the prototype can be developed into the actual interface and delivered with the rest of the product.

Both techniques are sometimes called rapid prototyping because they build sections of the proposed system to determine the necessity, the desirability or feasibility of requirements. The term "rapid" distinguishes the prototype from that used in engineering, where a small system or subsystem is built after the design is completed. But, in rapid prototyping, choices are evaluated before design is created. The purpose of the rapid prototype is to help us understand and design on a successful final design.

3.2.4 Prototyping Designs

At the design stage, prototyping have many of its advantages too. A feasible prototype allows us to find out in the design stage whether the solution that is propose will actually solve the problem at hand. Therefore, prototyping actually encouraged communication between users and the developers to explore areas of uncertainty that arise in designing a solution. Hence, many issues can be resolved before coding begin, and avoid the creation of many more problems during testing phase.

3.3 Development Strategy For Interactive Multimedia Learning Science With Puzzles

IML Science with Puzzles is going to be developed using the prototyping approach. As a result of it, the strategy or plan to develop this project will follow closely the steps that are involved in the prototyping model. The steps taken by this project are described below.

3.4 System Analysis

System analysis is an activity that encompasses most of the task that is collectively called computerized system engineering. System analysis enables the system engineer to specify the software functions and performance, to indicate the software interface with other elements and to establish design constraints that the software must meet. The system analysis should have the following objectives:

- Identify user's need
- Evaluate the system's concept of feasibility studies

- Perform economic and technical analysis
- Allocate functions to hardware, software, people, database and other system elements

Create a system specification definition that describes the functional and non-functional requirements

3.4.1 Information Gathering Methods

This refers to the methods that are used to gather information regarding a system. It is necessary to employ the fact-finding techniques in order to establish understanding of the state and future requirements. The techniques used to obtain the needed information are:

- **Printed Resources:** Material like journals let me have a better understanding the capabilities, feasibility and the possibilities on how the system should be designed to give the best of it. Reference books were read to get information and a clearer picture how the system should be developed. Besides that, past year's theses were referred too.
- **Internet:** The main resource to search for information and to refer any ambiguities that arise during the entire development period. Vast information could be found from the software of the system to the design of the system. Besides that, existing sites for kid learning is being observed the advantages and disadvantages. This can guide me to design my system more effectively.
- **Kids Software In The Market:** I also had a play with the available software for kids in learning. Here, I can have a better idea and creative in implementing my system for children in educating them.
- **Interview:** An informal interview was done among my friends and my relatives. Resources on what software to use, and why were asked through their own experience of using the software. Having an

informal sharing of questions and answers to get information from the children itself their thoughts and need in studying science and using computer to study.

3.4.2 System Requirements Analysis

A. Non-Functional Requirement

A non-functional requirements or constraint describes a restriction on the system that limits one choices for constructing a solution to the problem (Pfleeger, 1998). Non-functional requirement for this project is described as below: -

- **User-Friendly**: The usage of suitable and meaningful options and icons will help the user to use the system with more confidence, easy and save time. Users are allowed to browse and use the site without any problem.
- **Usability**: The application system must be easy to use. They can enhance and support rather than limit or restrict business processes.
- **Attractive & Interactive Interface**: With attractive interface, users will be able to enjoy surfing the website. With an interactive multimedia, the users are more comfortable and can have fun while visiting this website.
- **Reliability**: The reliability is to convince the user that this system will make the correct respond and provide error-handling ability.

B. Functional Requirement

A functional requirements describe an interaction between the system and its environment. Further, functional requirements describe how the system should behave given the certain stimuli (Pfleeger, 1998). It

other words, it explain what the system will do. The functional requirement is explained as below: -

- **Lesson Module:** This module will have short lessons available to educate the children about basic science in world. The purpose is to educate the student interactively so that they will feel relax and fun to learn science, besides cultivating a positive attitudes to the children in learning science. There will be pictures (animated or non-animated), and attractive background to draw the attention of the students in learning.
- **Puzzles Quiz:** The purpose of this system is implementing puzzles to the students in learning science. It requires knowledge from the students as well a bit of brainstorming in solving the puzzles. The puzzles quiz here will be more on puzzles solving the questions like the objectives, fill in the answers, and word search. The module here able to identify students understanding and knowledge in science. It will also required a little general knowledge of the students as well.
- **Puzzles Games:** To make this web page more attractive and fun to visit, the puzzles games will be able to let the students to have fun in playing the game. While playing the available games, it will also enhance the students understanding in solving the games puzzles. This will be an encouragement for the students to build up their interest in learning as well as studying.

3.5 Development Platform

The word 'platform' was traditionally associated with hardware: the computer platform. But a platform can also describe software as well as hardware, and it is increasingly used in this way. For an offline application this might mean the operating system, such as Windows NT, while for an online project it is more likely to refer to the browser, such as Netscape Navigator or Internet Explorer. A useful definition might be that the platform is whatever you have to specify in order to run the application. Often the specification will be extended to say what kind of display is needed, or how big a hard disk, or how fast an Internet connection.

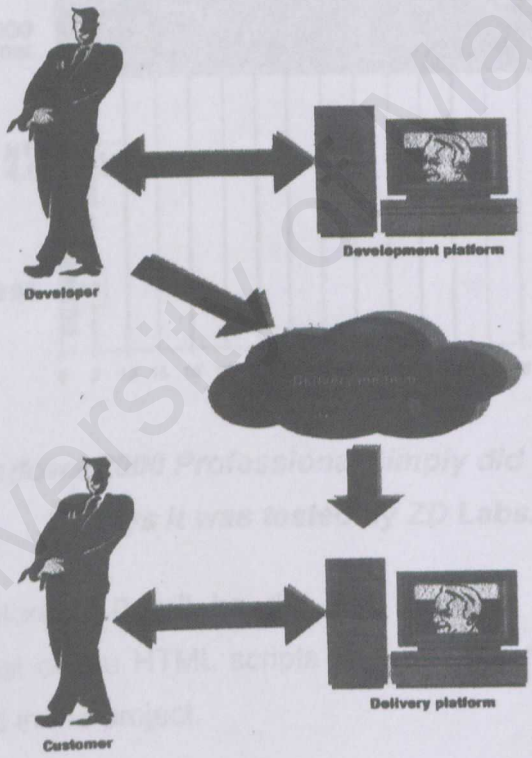


Figure 3.2: Platform Relationship

3.5.1 Operating System & Platform

In the analysis of the entire platform, the Microsoft product is used as the main the system platform.

- Windows 2000 is used because it is proven that Windows 2000 Professional is up to 30% faster and according to NSTL tests, 13 times more reliable than Windows 98.

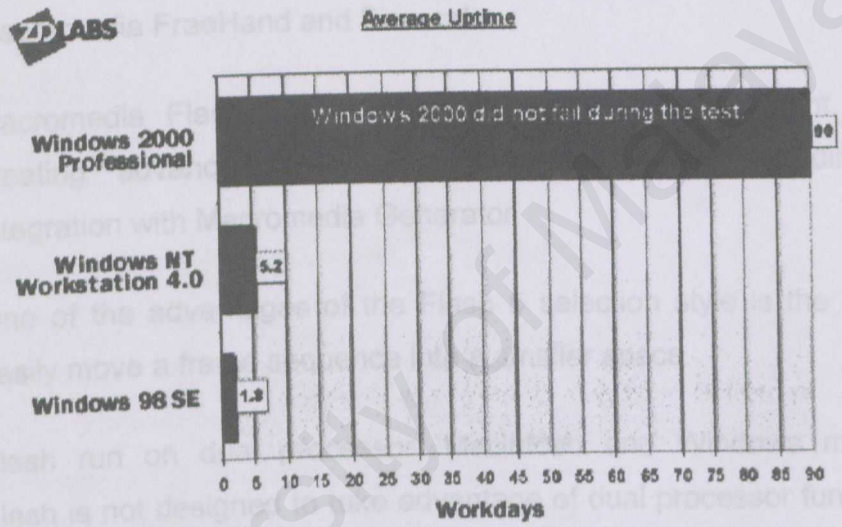


Figure 3.3: Windows 2000 Professional simply did not fail during the 90 days it was tested by ZD Labs.

- Internet Explorer 5.0 will be the web browser for this system. It supports most of the HTML scripts and also the ActiveX Data Object that are used in the project.

3.5.2 Development Software

a) Flash 5.0

Macromedia Flash 5 fuses the precision and flexibility of vector graphics with bitmaps, audio, and advanced interactivity to create brilliant and effective Web experiences that attract and engage visitors.

A designer – friendly application, Macromedia Flash 5 easily integrates with web production workflow, supporting direct import from Macromedia FreeHand and Fireworks.

Macromedia Flash 5 also provides powerful development tool for creating advanced web sites and applications, including tight integration with Macromedia Generator.

One of the advantages of the Flash 5 selection style is the ability to easily move a frame sequence into a smaller space.

Flash run on dual processor, Macintosh and Windows machines. Flash is not designed to take advantage of dual processor functionality and will not run faster than on single processor machines.

b) Adobe Illustrator 8.0

The Adobe Illustrator 8.0 is used to design animated graphics and also in editing some of the pictures that will be inserted into the system. Illustrator is a tool that create many pictures by the user itself and adding color to the pictures.

c) Adobe Photoshop 6.0

The Adobe Photoshop 6.0 is used to design and modify the graphical picture that is needed for the package. Some of the pictures were scanned from the pictures that pasted in the reference book or other resources. Pictures retrieved from web-page can also be edited using this tool. It is indeed Adobe Photoshop is a software suitable to modify and improved the quality of the pictures and figures.

3.6 Conclusion

The following tools and technology are used for this system: -

- Windows 2000 Professional as the platform
- Macromedia Flash 5
- Adobe Illustrator 8.0
- Adobe Photoshop 6.0
- Microsoft Office 2000 for documentation
- Note Pad for scripting.
- Internet Explore 5.0 as web browser

The following are the hardware requirements that are needed to build this system:-

- 32 MB of free available system RAM
- 40 MB of available disk space
- 256 color monitor capable of 800x600 resolution
- 1.44 MB Floppy Drive and diskettes

- Standard keyboard
- Speaker
- Canon Bubble Jet SP2000 Printer
- Mouse

CHAPTER 4: SYSTEM DESIGN

CHAPTER 4: System Design

4.1 Introduction

According to Webster, the process of design involves "conceiving and planning out in the mind" and "making a drawing, pattern, or sketch of". Design is the creative process of transforming the problem into a solution and the description of the solution (Pelfre, 1998).

System design is the evolution of alternative solution and the specification of a detailed computer – based solution. During this phase, the detail of how the system will meet the requirements identified during the requirement phase is described. Then the user requirements will be transformed into a working model. A working model is used as guidance to developer before developing the complete system.

4.2 User Interface Design

The interface is the infrastructure of the application. All online and off line Web sites and application have an infrastructure that links the component parts together so that users understand what is contained in them, how the information is organizes, and what they need to do to activate the separate pieces. An analogy that is often used refers to navigation within the application and the routes that the users can explore (England & Finney, 1999).

Interface is used in many different kinds of purpose such as for searching, as a tool, browsers, buying, learning and entertaining. In designing interfaces, few factors have to be considered in order to make the interface look attractive and easy to navigate by the user. It is also

important to keep the interface simple yet attractive in order to keep the user interested.

- **Limit Memory Loads:** People have short-term memory, so after 20 seconds they will lose the information if they cannot quickly store it in long-term memory.
- **Break down decision making:** Decision steps have to be broken down into manageable parts using group boxes and labels to help them distinguish which decision they should be making at a given point of time.
- **Provide context:** Context provides specific meaning and interpretation. Some ways of providing context are using titles, labels on screen titles, buttons, and menus.
- **Be consistent:** The font, size, and way of approaching must be consistent so that it will give a focus view for the user. The user may find it easy and comfortable as well.
- **Be forgiving:** The interface has to allow user to explore without doing damage. There has to be built in ways for users to cancel out, go back, and undo action.
- **Minimize the eye movement:** It can be tiring if the eyes' movement is not minimized. Minimizing the eye movement enable the user to be more concentrate and more focus in it.
- **Adhere to principles of good format and layout:** This can allow a good presentable interface besides making it look need and organize instead of confusing interface.
- **Use of color:** The use of background colors, the colors of text against a colored background, color linked with layout, and the awareness of color-blindness in a percentage of the audience were all factors that need to be considered. The selection of colors need

to be readability and legibility. The common examples of Western color psychology are like *red* (stop, danger, heat, appliance is on), *blue* (cold, water, sky), *green* (go, environmentally friendly).

- **Use of sound:** Sound means any type of audio use. It can help the user to identify the selection of a picon (icon) or giving a notification to the user. It is meant to contribute enhancement in using the interface and not annoying the user. Therefore, selection of sounds must be appropriate.

4.2.1 Graphical User Interface (GUI)

A graphical user interface (GUI) presents a pictorial interface to a program. A GUI (pronounced "GOO-EE) gives a program a distinctive "look" and "feel". By providing different applications with a consistent set of intuitive user interface components. GUIs allow the user to spend less time trying to remember which keystroke sequences do what and spend more time using the program in a productive manner.

4.3 Modules Of Interactive Multimedia Learning Science With Puzzles

There are 3 main modules for users to explore. Two sub-modules will be added as guidance for the users to be more familiar and user-friendly when using the system.

The main modules are:

1. **Lessons**

   This module serves the purpose of presenting information about science in a simple lessons approach. The desire is to see that the user will be able to gain information about science in various categories and able to help them absorbed the knowledge more effectively. The lessons will be an interactive lesson to attract and make user feel comfortable in learning.

2. **Puzzles Quiz**

   This module contains puzzles quiz where the users can test their knowledge. The puzzles here will be answering the objectives questions to test the students in their knowledge after being exposed to science. There will be also filling in the answer for a sentence and determine the statement true or false - where it will be able to help the students in strengthening their understanding. Besides that, searching words in a box helping the students enhancing their memory. The reason of using puzzles way is to determine that using puzzles approach can be one of the ways in learning and teaching. Besides, this module will examine whether the user really know about what they have learned.

3. **Puzzles Games**

   This module allows the children to have some fun and excitement in playing games. The user has to solve the puzzles that are asked in each stage till the user reach the end of the game and succeed. They will be various type of games that the user can enjoy and explore.

4.4 System Structured Chart

Structured charts are used during architectural design to document hierarchical structure, parameters, and interconnections in a system. A structure chart differs from a flowchart in two ways: a structure chart has no decision boxes, and the sequential ordering of tasks inherent in a flowchart can be suppressed in a structure chart (Fairley, 1985).

Below is the structured chart for Interactive Multimedia Learning Science With Puzzles: -

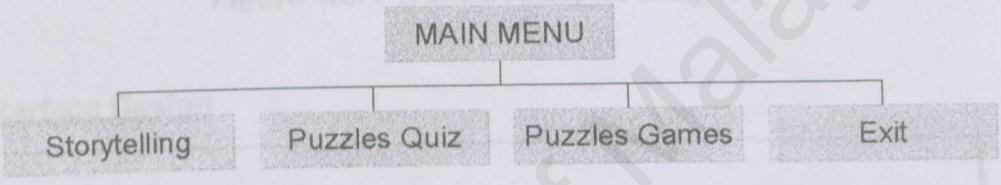


Figure 4.1: System Modules of Interactive Multimedia Learning Science With Puzzles

4.5 Pyramid Analysis Diagram

The pyramid Analysis Diagram is a technique used to split up the course content of into manageable chunks. These chunks are then combined into modules. Then the order in which to develop them and the chosen media can be decided.

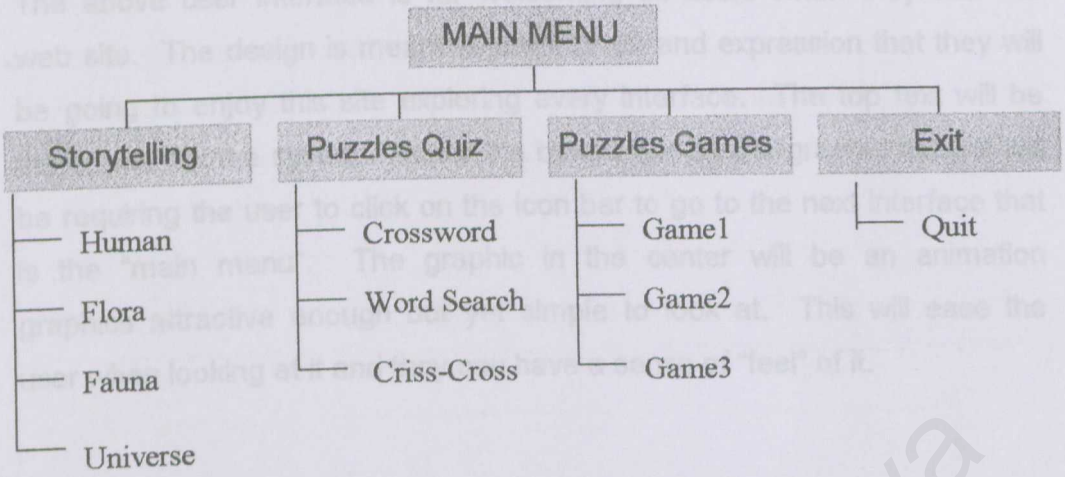


Figure 4.2: Pyramid Analysis Diagram

4.6 Interface Design

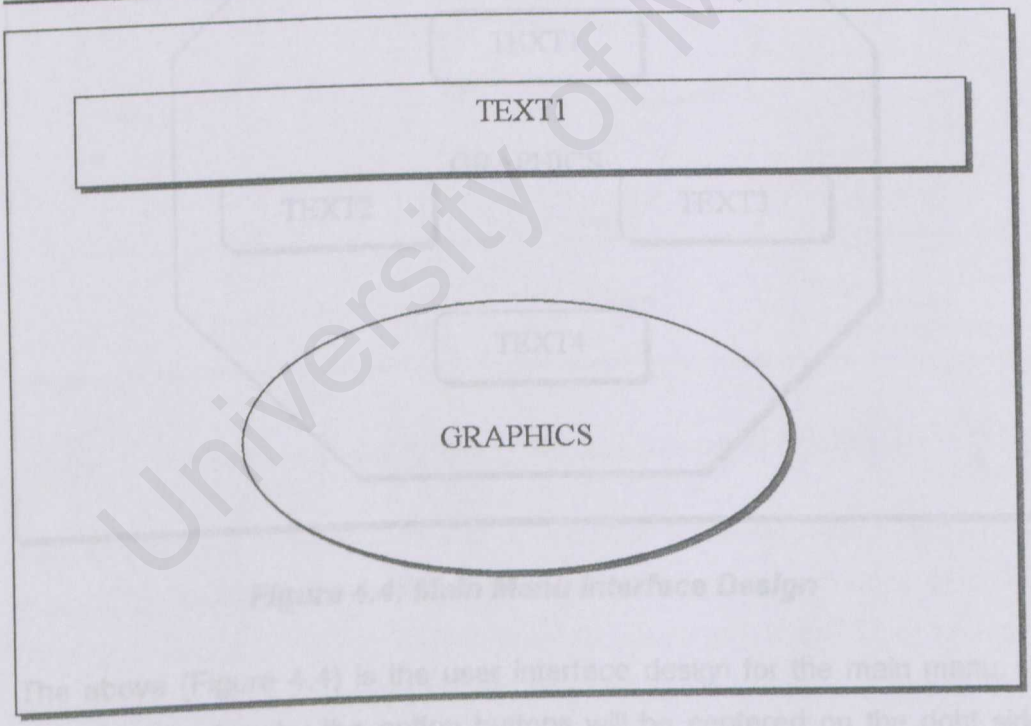


Figure 4.3: Welcoming Interface Design

The above user interface is for welcoming all users when they visit this web site. The design is meant where it given and expression that they will be going to enjoy this site exploring every interface. The top text will be the theme for the system. As for the button just on the graphic itself, it will be requiring the user to click on the icon bar to go to the next interface that is the "main menu". The graphic in the center will be an animation graphics attractive enough but yet simple to look at. This will ease the user when looking at it and they can have a sense of "feel" of it.

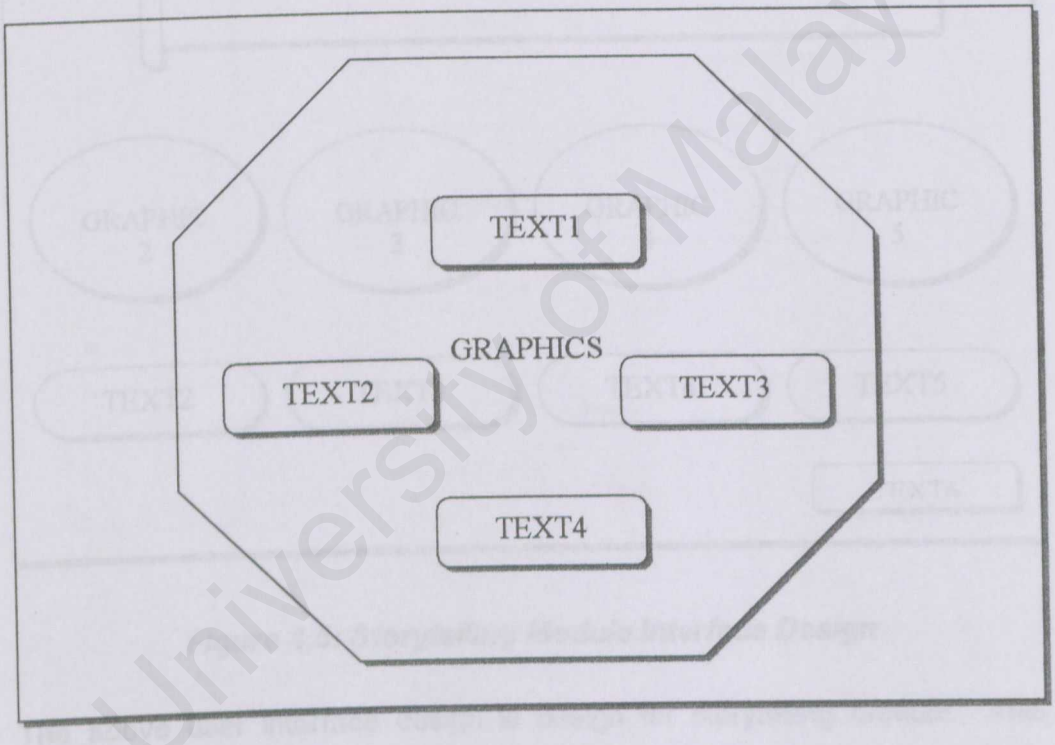


Figure 4.4: Main Menu Interface Design

The above (Figure 4.4) is the user interface design for the main menu. It is designed whereby the option buttons will be centered on the right side of the screen. The three texts (*TEXT1, TEXT2, TEXT3*) will be the option buttons, which the user needs to select to enter the next screen. This

three option buttons are the main module of the system – puzzles, quiz puzzles, and puzzles games. All these three buttons will be added features and animation to alert the user that it have the function of a button. As for *TEXT4*, it will be the quit button, allowing the user to come out from the system.

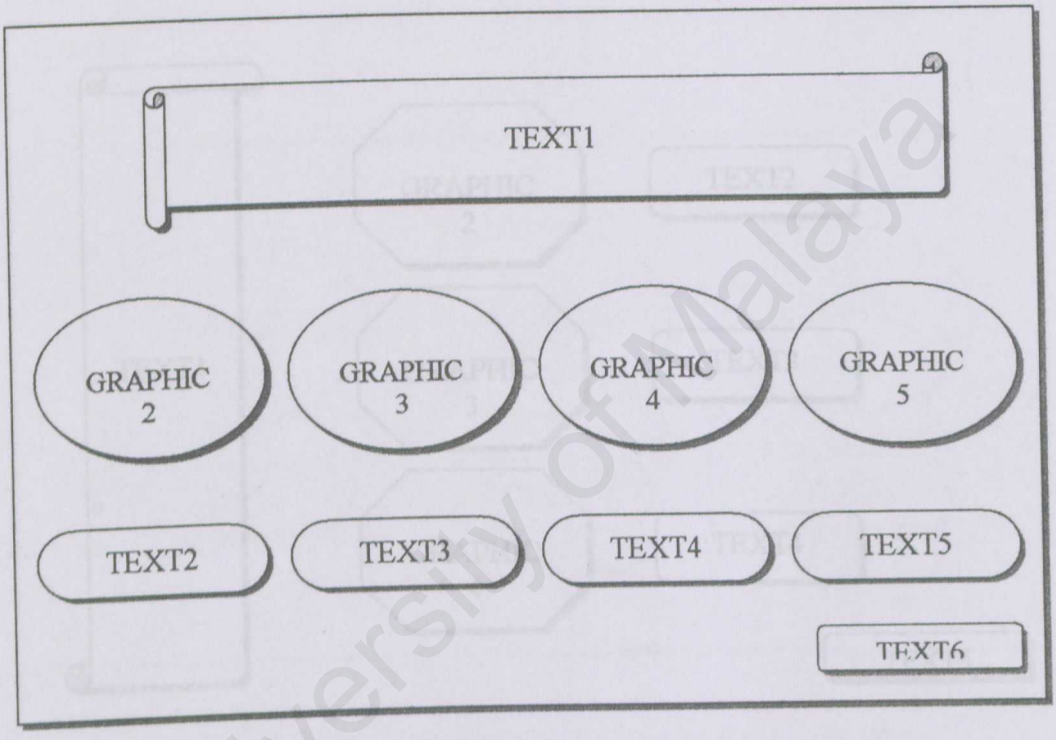


Figure 4.5: Storytelling Module Interface Design

The above user interface design is design for storytelling module. This module consists of four categories, which the user can choose (*TEXT2, TEXT3, TEXT4, TEXT5*). The selection categories are the "human", "flora", "fauna", and "universe" category. After each selection, user will enter into a world of storytelling, which directly will impart knowledge to the user. User can also choose to click on the graphics (*GRAPHIC2,*

GRAPHIC3, GRAPHIC4, GRAPHIC5). Each of the graphic will be related with the text. For example, *GRAPHIC2* will be an animation picture of human and the *TEXT2* will be the word "human". The top text above will be the title of this module – storytelling. The bottom right will be the "home" option to return to the main menu.

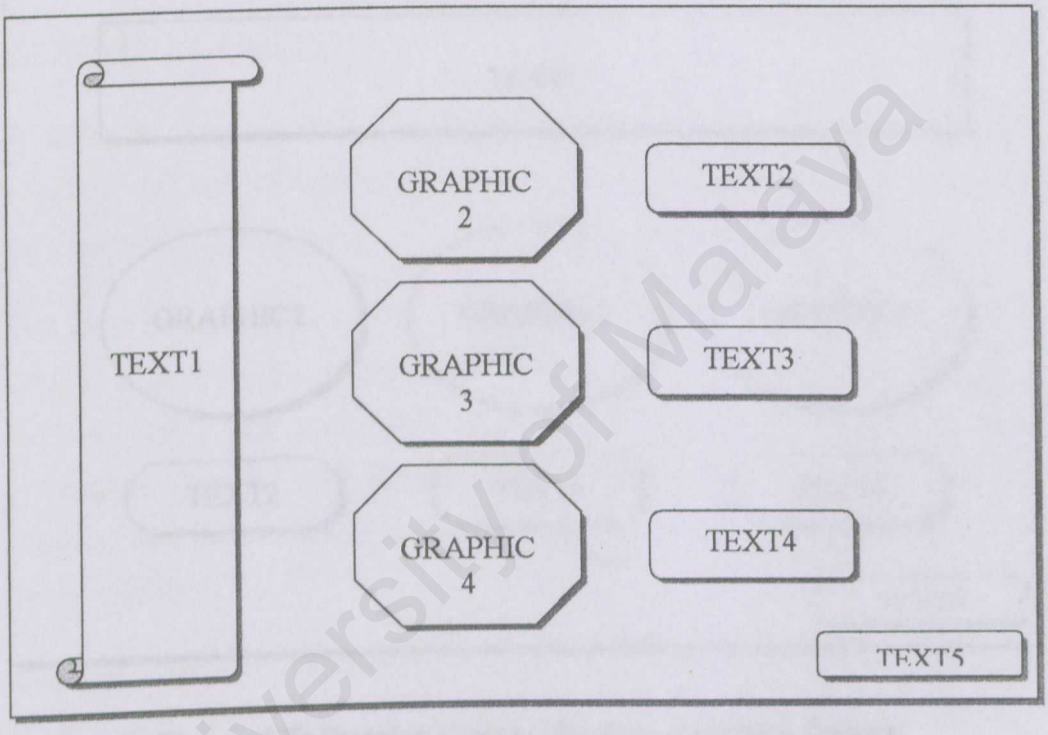


Figure 4.6: Puzzles Quiz Module Interface Design

The user interface design for puzzles quiz module is shown as above. The title of this module will be shown in *TEXT1*, which is on the left hand side of the screen. The graphic in *GRAPHIC2* will be related picture with *TEXT2* and the same goes for *GRAPHIC3* with *TEXT3* and *GRAPHIC4* with *TEXT4*. The graphic and the text will be an option for the user, therefore, the user can either click on the graphic or the text. This user

interface will be designed in a way where the user will be able to understand that they will be playing some puzzles when the look at the interface. As usual, the bottom right text will be the "home" option button to enable the user to return to the main menu.

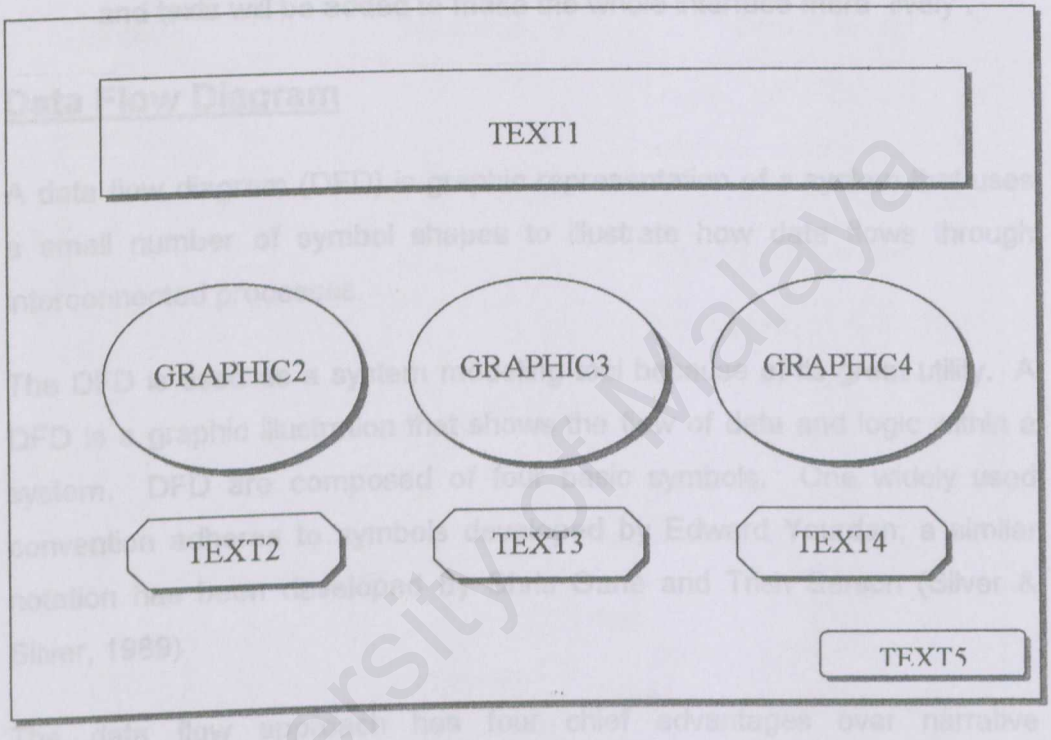


Figure 4.7: Puzzles Games Module Interface Design

The above figure shows the user interface design for the puzzles games module. *TEXT1* will be the title of this module. Like the above two interface design – storytelling module, puzzles quiz module – the selection animation graphic will be related with the text below the graphic. User can either select the option from the graphic itself or the text. And as for *TEXT5*, which is at the bottom right, it will be the "home" option button for user to click on in returning the main menu scene.

4.6.1 Summary Of The Interface Design

The whole user interface design will be interactive and selection of color will not be taken lightly. The interface will not be to compact and complicated till it might "blur" the user while looking at it and making the user feeling uncomfortable. Animation of the graphics and texts will be added to make the whole interface more "lively".

4.7 Data Flow Diagram

A data flow diagram (DFD) is graphic representation of a system that uses a small number of symbol shapes to illustrate how data flows through interconnected processes.

The DFD is used as a system modeling tool because of its great utility. A DFD is a graphic illustration that shows the flow of data and logic within a system. DFD are composed of four basic symbols. One widely used convention adheres to symbols developed by Edward Yourdan; a similar notation has been developed by Chris Gane and Trish Sarson (Silver & Silver, 1989)

The data flow approach has four chief advantages over narrative explanations of the way data moves through the system. The advantages are: -

- Freedom from committing to the technical implementation of the system too early.
- Further understanding of the interrelatedness of systems and subsystems.
- Communicating current system knowledge to users through data flow diagrams.

- Analysis of a proposed system to determine if the necessary data and processes have been defined.

There are four basic symbols used to chart the data movement on DFD. The following table explained the symbols: -

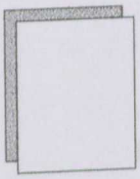
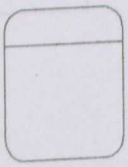
Symbols	*Meaning*	*Description*
	Entity	Used to depict an external entity that can send data to or receive data from the system
	Flow of Data	Movement of data from one point to another, with the head pointing towards the data destination
	Process	Show occurrence of a transformation of data
	Data Store	Used to represent a data store where the data is held within the system

Table 4.1: Symbols used in DFD

The following DFDs will illustrate the data flow diagram of each module in the Interactive Multimedia Learning Science With Puzzles system: -

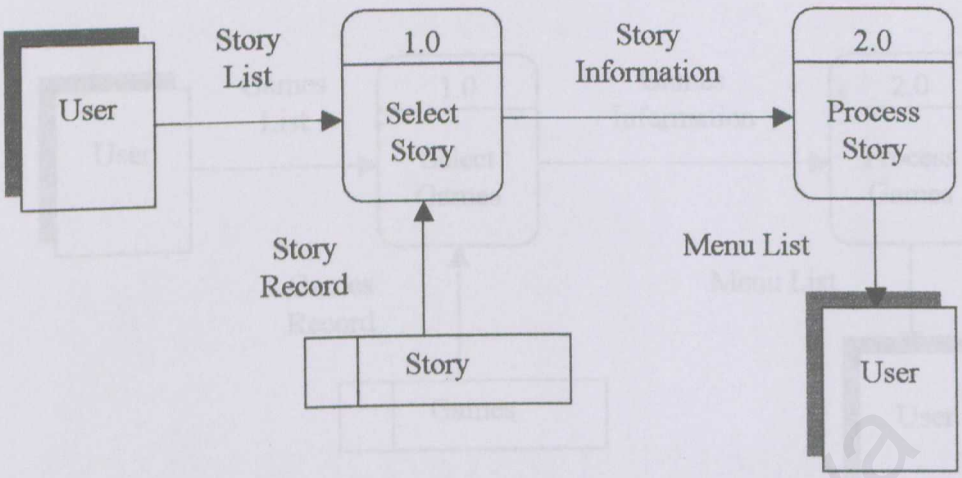


Figure 4.8: Data Flow Diagram For Storytelling

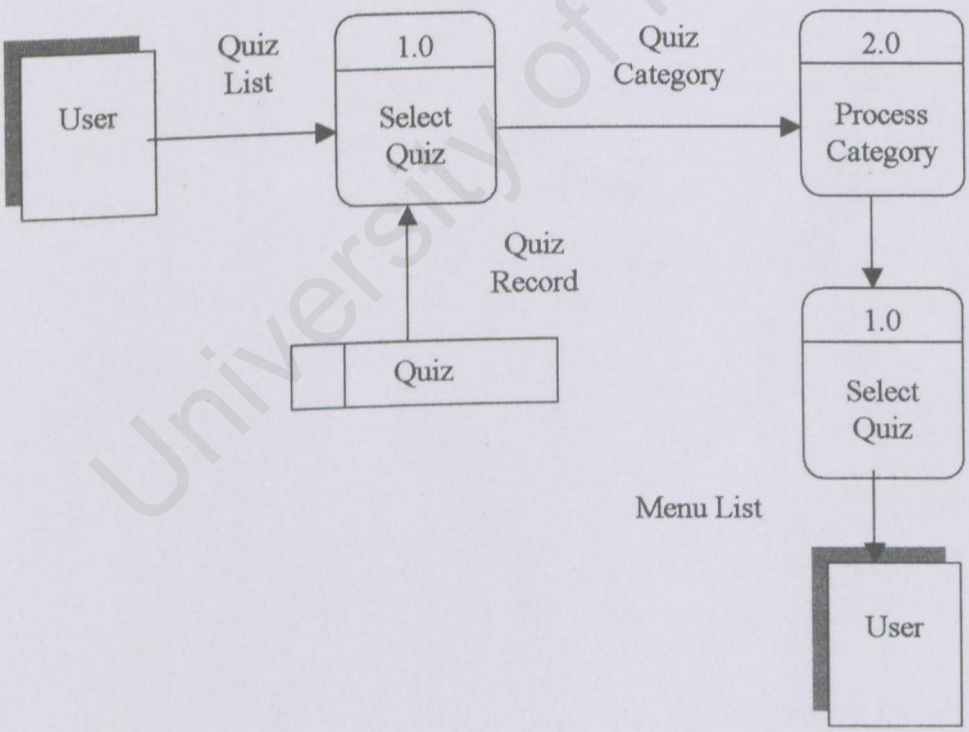


Figure 4.9: Data Flow Diagram For Puzzles Quiz

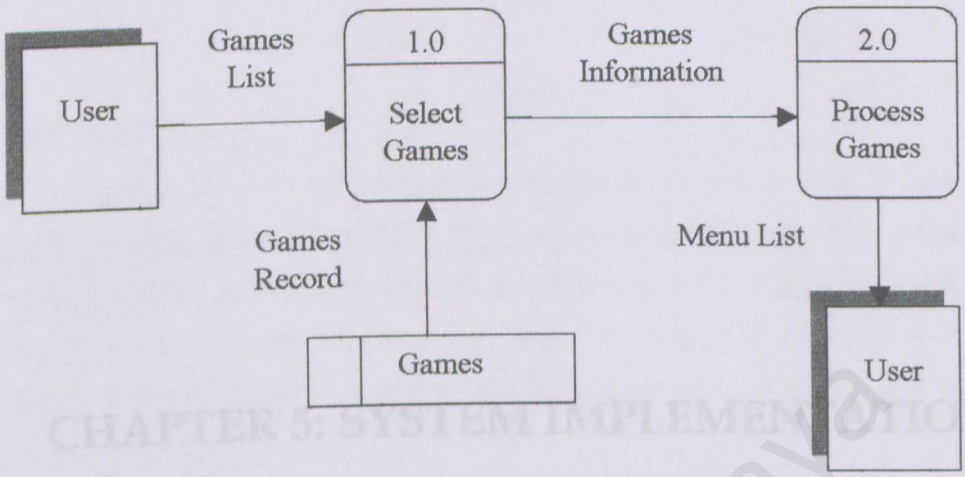


Figure 4.10: Data Flow Diagram for Puzzles Games

CHAPTER 5: SYSTEM IMPLEMENTATION

CHAPTER 5: System Implementation

5.1 System Coding

After designing the system, the following stage is the writing of the program. In this phase, the focus is on implementing the solution as a software. In other words, the program that implement the design must be written carefully in order to meet the goal. Coding is a process that translates a detail design representation of software into a programming language realization.

There are many ways to implement a design. Nowadays, there are many languages and tools that can be used in implementing a design. Since this package is built in using Macromedia Flash 5, the scripting language that will be used is ActionScript.

In general, all programming languages allow a problem to be solved in a variety of ways. ActionScript is the programming language of Flash that allows user to do many wonderful things once the user has master the language. Flash is popular and powerful multimedia software, which is frequent highly used by the western countries. Now, many of the animation companies in Malaysia are also starting to use Flash in the company's projects.

Coding perform tasks that translate design into a machine-readable form. If design is performed in a detailed manner, code-generation can be accomplished mechanistically (Pressman, 1992).

5.2 Coding Principles

Few principles were applied during the implementation. It is advisable to follow as closely as possible to avoid any complicated or confusion throughout the implementing stage.

The following principles were applied: -

- **Modularity**

  Before entering the coding phase, developer has divided the project into several modules. The main purpose of modularity is to reduce the complexity of the system.

- **Coding conventions**

  A good and meaningful naming technique for the variables, controls and modules provides easy identification for the programmer. The naming convention is created with coding consistency and standardization in mind.

- **Readability**

  Codes should be easy to understand. Adherence to coding conventions such as naming conventions and indentation contribute to program readability.

- **Internal Documentation**

  Internal documentation and comments provide a clear guide to the developer and reader about the function of a particular source code in the program. Therefore, comments actually provide the developer with a means of communicating with other readers of the source code. A statement of purpose indicating the function of the module and descriptive comments are embedded within the body of source code is used to describe processing functions.

- **Maintainability**

  Codes should be easily revised or corrected. To facilitate maintenance, code should be readable, modular and as general as possible.

- **Robustness**

  The codes should be able to handle cases for user error by responding appropriately. It should be able to avoid any abrupt termination or failure system.

5.3 Action Script

Action Script is the scripting language Flash uses to control its movies and objects within the movies. Action Script is a norm when creating anything interactive in Flash. It allows executing different actions in a movie depending on what a user does or on what frame of the movie is being played (Dan Livingston, *Advanced Flash 5 ActionScript in Action*, 2001)

Action Script is also called *object-oriented* scripting languages. All movie clips are objects (also called *instances*) of the class MovieClip. Therefore, the objects all have the same properties and the same methods.

5.3.1 Action Panels

The Action panels are just a kind of panel, much like the other panels in Flash 5, such as Frame, Sound, or Align. Flash 5 will recognize any code that is place in an Action panel immediately – you don't have to save the File to test it. The Action panel toggles between the Object Actions (actions applied to movie clips and buttons) or Frame Actions depending on what you've selected.

Example of action script coding (*extract from the system*): -

a) Objective Questions

```
on (release) {
    /:CurrentAnswer = "A";
    call ("/Library/:AnswerQuestion");
}
```

This action sets the value of CurrentAnswer to A and then calls the AnswerQuestion function contained in the ActionScript Library symbol. AnswerQuestion handles the comparison between CurrentAnswer and the correct answer for each questions, and triggers a series of events accordingly.

```
on (release) {
    setProperty ("", _visible, false);
    call ("/Library/:DisplayQuestion");
    if (Number(/:CurrentQuestion) == 5) {
        if (Number(/:CorrectCount) == 4) {
            tellTarget ("/LevelScreens") {
                play ();
            }
        } else {
            tellTarget ("/RetryScreen") {
                play ();
            }
        }
    }
}
```

The above action is for continue button in the objective questions. It perform several tasks. First, it set the visibility of the parent movie clip to *false*, making the continue button invisible. The action then prompt the next question to be displayed then check to see whether the current level has been completed, and completed correctly. The action plays level screen or retry screen, depending on the outcome of the current level.

b) Games

```
WordLength = length(CurrentWord);
LetterCounter = 0;
Correct = false;
while (Number(LetterCounter)<Number(WordLength)) {
    LetterCounter = Number(LetterCounter)+1;
    LoopCount = Number(LoopCount)+1;
    if ((eval("/Letter" add LetterCounter add "/Wheel:CurrentLetter") eq
/LetterButtons:CurrentLetter) and (eval("/Letter" add LetterCounter add
"/Wheel:On") == True) ) {
            Correct = true;
            tellTarget ("/Letter" add LetterCounter) {
                    /:LettersRemaining = /:LettersRemaining-1;
                    Wheel:On = false;
                    gotoAndStop ("Off");
            }
    }
}
if (Number(Correct) == Number(false)) {
    tellTarget ("/Giggle") {
```

```
            nextFrame ();
        }
    }
    if (Number(/:LettersRemaining) == 0) {
        call ("Win");
    }
```

The above action is executed every time one of the letter buttons is clicked. It takes the letter selected by the player and compares it to each letter in the current word. When it finds a match, the appropriate letters are revealed and the player progresses in the game. If no match is found, the wooden mallet rises one notch higher and Bonky begin to look a little more nervous. The action also tracks the number of letters left to be guessed. When the remaining guessing letter reaches zero, the win frame is called.

```
tellTarget ("/Win") {
    play ();
}
tellTarget ("/LetterButtons") {
    gotoAndStop ("Off");
}
tellTarget ("/GameScreens") {
    gotoAndPlay ("Win");
}
```

The above action is for the win frame. The action basically does three things: plays the win animation, turns off the letter button to prevent further input, and lastly send the GameScreen symbol to display message.

5.4 Importing Bitmaps

Image, graphics, illustrations, photograph and rendering are all bitmaps, which are the arrangements of color pixels in computer format. Bitmaps can be import to Flash directly. There are a variety of formats that can be imported into Flash.

Any of the below formatted files can be imported: -

- **BMP** – a common windows graphics format.
- **GIF** – a format known as the Graphics Interchange Format. It is now known as one of the two standard image formats of the internet.
- **JPEG** – define as Joint Photographers Experts Group as a high quality compressed image format. This is the other standard image formats of the internet.
- **Photoshop** – the native format of Adobe Photoshop.
- **PNG** – PNG is the only cross-platform bitmap format that supports transparency (an alpha channel).

5.4.1 Editing Bitmaps

Adobe Illustrator and Adobe Photoshop are used in editing the bitmaps.

5.4.1.1 Using Adobe Photoshop 6.0

Adobe Photoshop has the functionality to convert a certain bitmap format into another bitmap format (eg: from GIF file to JPEG file). Using the available tools can edit a more desirable picture.

Using Photoshop can edit the graphic into a transparent background (PNG file). This will able to clear unwanted background that will affect the whole interface when inserting the picture.

5.4.1.2 Using Adobe Illustrator 8.0

Adobe Illustrator is used to draw graphics and later putting all the graphics together in flash to create animation graphics. The available tools ease the editing task.

Editing a graphic also can be done. Firstly, break the graphics apart. Later, select parts of the graphics that need to change and alter to a graphic that desire. Lastly, regroup the graphic and a new graphic has just been created.

5.5 Text Members

It is important to use text that is readable and not eyes soaring. Flash 5 can edit the text with different fonts, color or rotating the text as desired. The editing of the text can be done using the text properties, which is available in Flash 5.

Besides that, Flash also allows importing text from Microsoft Word to Flash. In result, it can ease the work in typing text in Flash by just transferring from Microsoft Word to Flash.

5.5.1 Text Editing

Flash allows editing text and also create text animation too. Therefore, text in Flash won't look so stagnant and bored.

Open Character panel window; edit the text into a desirable color, font type, size of the font, or any changes to be done.

Making animation of the text can also be done. Allowing text effect, like the change of the color, or routing the text 360 degree will do some animation to the text. But, first the text must be convert to either as a movie clip or a button function.

5.5.2 Importing Text

Flash also allowed importing text from other programs like Microsoft Words.

First, create a desirable text in Microsoft Word (maybe using WordArt). After several amendment made and satisfied, copy the text. Next, just paste the text in the stage (Flash). Finally, adjust the size of the text till a desirable size.

5.6 Sound

Flash can only support .wav sound file for Windows.

Flash offers a number of ways to use sounds. It can make sounds that play continuously, independent of the Timeline, or synchronize animation to a sound track. It can attach sounds to buttons to make them more interactive, and make sounds fade in and out for a more polished sound track.

5.6.1 Importing Sound

Importing sound into Flash requires only 2 simple steps. Firstly, choose file > import. Next, in the import dialog box, just locate and open the desired sound file. Automatically, the imported sound is placed in the library for the current movie.

5.7 Graphics Animation

Animation in Macromedia Flash is divided into two types – *tweening* animation and *frame-by-frame* animation.

5.7.1 Tweening animation

Tweening animation involves the process of changing the position, size, colors, features or rotating the object from the first frame to the last frame in a timeline.

The steps in creating tweened animation is as simple as ABC, but it really required a lot time to adjust the desire effect by doing repetition testing unto it.

Firstly, select the first frame to create motion tween. Then, in the timeline select the type of features that you want. The choice of effect that can be choose from is brightness of the color, tint color & alpha color.

After several testing, you will have the animated graphic ready to be used. Of course, future enhancement and changes still can be done. Just click on the movie clips to make any amendments.

5.7.2 Frame-by-frame animation.

Frame-by-frame animation changes the contents of the Stage in every frame and is best suited to complex animation in which an image changes in every frame instead of simply moving. Frame-by-frame animation increases file size more rapidly than tweened animation.

Frame-by-frame animation required much effort and times to be sure that the animation will be a smooth animation. It mostly use when need to change the animation in each image. Example of this animation is like people walking or dog jumping.

It required at least two different movement pictures to make an animation. Here, I use Adobe Illustrator 8.0 to draw my pictures. After that, I import the pictures into Flash 5 and start creating animation graphics.

Loop the animation, so that it will play again and again instead of one time only. Several test need to be done to ensure that the animation would not look awkward when it's played.

5.8 Mask Layer

For spotlight effects and transitions, you can use a mask layer to create a hole through which the contents of one or more underlying layers are visible. You can group multiple layers together under a single mask layer to create sophisticated effects. You can also use any type of animation, except motion paths, to make the mask move. You cannot mask layers inside of buttons.

To create a mask layer, you place a filled shape on the layer. The mask layer reveals the area of linked, underlying layers that lie beneath the filled shape, and it conceals all other areas. Mask layers can contain only a single shape, instance, or type object (Macromedia Flash 5, 2000).

5.9 Linking The Scene

Flash involves different scenes to create a flash movie. All these must be linked together so that it can run in a single flash movie. Linking all these scenes will require button action to do the job.

5.9.1 Linking Steps

Linking the scenes will require script. In any of the buttons, click on the button. Open the Window menu and select Actions (or right button click to go to Actions).

The following code is enter:

```
on (release)
{
    gotoAndPlay ("frame","1");
}
```

To make the scene does not jump to previous scene, click on any other frame (besides the buttons frame) to stop it.

The following code is enter:

```
stop();
```

5.10 Publishing The Movie

The Flash Player format (SWF) is the main file format for distributing Flash content, and the only format that supports all the interactive functionality of Flash.

Flash Player movie can be played in the following ways:

- In Internet browsers such as Netscape Navigator and Internet Explorer that are equipped with the Flash Player
- With the Flash Xtra in Director and Authorware
- With the Flash ActiveX control in Microsoft Office and other ActiveX hosts
- As part of a QuickTime movie
- As a type of stand-alone application called a projector

5.11 Conclusion

During this phase, the most important things that need to take notes are consistency and readability. Without this two important element, scripting may turn out to be more complicated and confusing.

Flash 5 used ActionScript in scripting the language. Its able to control movies and object within the movies by just using action. An action is roughly means "*a chunk of ActionScript code that does something*".

Animation and text features can also be done in Flash 5 by using the given tools, properties and effect function in it. It can create wonderful things that anyone can imagine of.

Flash 5 can easily publish the movie when the movie is ready. This concluded all the actions into Flash player movie.

CHAPTER 6: TESTING

CHAPTER 6: System Testing

6.1 Testing

Testing is a verification and validation process. Verification refers to a set of activities that ensure that the software is correctly implements with the specific functions. It involves using test data and scenarios to verify that each component and the whole system work under normal and abnormal circumstances.

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. Rules that can serve well as testing objective are: -

i) Testing is a process executing a program with the intent to find any error.

ii) A good test case is one that has a high probability of finding an undiscovered error.

iii) A successful test is one that uncovers a yet undiscovered error.

A system is exposed to testing both during the development phase and during the test and integration phase. During the development phase each function or procedure that is a part of a module is independently developed and thoroughly tested until the entire module is complete.

6.2 System Testing

System testing is a critical element of software quality assurance. System testing is required to ensure the system runs according to its specification and in line with the users' requirement and expectation. Testing is not the first place where faults finding occur but testing is focus on finding faults,

and there are many ways to make the testing efforts more effective and efficient (Pfleeger, 1998)

Failure of software may be the result of any of several reasons: -

- The specification may be wrong or have missing requirement. The specification may not state exactly what the customer wants or needs.
- The specification may contain a requirement that is impossible to implement, given the prescribed hardware and software.
- The system design may contain a fault. The component description may contain an access algorithm that does not handle this case correctly.
- The program code may be wrong. It may implement the algorithm improperly or incompletely.

Fault identification is the process of determining what fault or faults caused the failure, and fault correction or removal is the process of making changes to the system so that the faults are removed (Pfleeger, 1998).

6.3 Types of testing

In developing a large system, testing usually involves several stages. Many types of tests are done before we can release the system to the customer with confidence that it will work properly. Some tests depend on what is being tested: components, groups of components, subsystems, or the whole system. Other tests depend on what we want to know: Is the system working according to the design? The requirements? The customer's expectation? (Pfleeger, 1998).

6.3.1 Unit Testing

Unit testing, also known as module testing or component testing is the first stage in testing. Each program in component is tested on its own, isolated from the other components in the system. It verifies that the component functions properly with the types of input expected from studying the component's design.

Unit testing is done in a controlled environment whenever possible so that predetermined set of data to the component being tested can be fed and observed the output actions and data are produced .

Unit testing is simplified when a module with high cohesion is designed. When only one function is addressed by a module, the number of test cases is reduced and errors can be more easily predicted and uncovered.

6.3.1.1 Buttons

In this program, unit testing has been conducted by testing each button on every page to determine the button respond to the right action. The buttons are checked one by one to ensure that the buttons linked to the right page and as well it will give the right respond that its assigned to. Since this package is developed mainly for children, the buttons are created in an attractive way so that it may be able to attract the attention of the children in every page. Each of these buttons are programmed with behaviors to react such as changes of the appearance and the movements when the user roll the mouse over or clicking on it. This is to give the assurance that the buttons are going to link user to another page or change of respond to the page.

In order to make sure that all the buttons work according to its desire, each buttons will be tested on each page. Repeated testing is done to

ensure the buttons function properly. This will make sure that the buttons will not give any confusion to the user while using the system.

6.3.1.2 Quality Check On Scene

The next steps to ensure that each scene is not too hard and painful to look at, quality assurance is checked. Graphics in scene are reorganized and making sure the choice of colors not too sharp when the user look at the screen.

Size of the buttons and words are checked to endure readability. This is important as this system main target is for little children. To ensure its readability, a child is asked to test and give feed back at some of the scenes.

6.4 Module Testing

A module is a collection of dependent components such as an object class, an abstract data type or some looser collection of procedures and functions. The main objective of doing module testing is to test the interfacing and integration between the tested units that form the module and to test the integration between the modules that form the system.

6.4.1 Testing On the Puzzles Module

Puzzles module consists of three sub-modules. Every sub modules is tested from scene to scene. Buttons are tested to check that the buttons link to the right scene. Types of buttons are also check so that the same type of buttons is used for the same sub modules or module. This will create a standard buttons and will not create any confusion to the user when using this courseware.

Each scene needed to check that it has the same idea and common interface, especially for the sub modules. This is done so that it will not create any drastic change in the interface design. Besides, it will give a consistency in the interface design.

Each of the questions is tested to confirm that the right question is asked at the right level. Spelling or grammatical errors are checked and changed when found.

6.4.2 Testing On The Lesson Module

Making sure that each of the buttons is link to the correct page is very crucial in this module. Each of the scene has its continuous lesson on each category. Buttons are checked again and again that the right action is assigned with the right scene to link to.

Sound is checked as well. Buttons are assigned with sound. Same buttons will have the same sound. Checking and rehearing the sound to make sure that the right sound is put and the sound is heard at the right timing.

Each scene needed to check that it has the same idea and common interface, especially for the sub modules. This is done so that it will not create any drastic change in the interface design. Besides, it will give a consistency in the interface design.

In this module they are many words and tables. Each sentence is checked for any spelling mistakes and grammatical wrongs. The tables need to make sure that it is not too small and are put in the standard position.

6.5 Integration Testing

Testing a specific features together with other newly developed features is known as integration testing. Testing the interface of the two components explores how components interact with each other.

Integration testing approach was applied during the development of this package. It was constructed and tested in small arguments, where error were easier to isolate and correct. Error will be corrected before proceeding to the next integration.

6.5.1 Integration testing of Puzzles Module With Lesson Module And Game Module

Here, testing is tested between the three different modules. Firstly, buttons are checked that it able to link from module to module and from scene to scene without any abrupt stop or jumping scene.

An overall check of sound to make sure that sound can still produced when it is integrated together with other modules. Assuring no mix up of sound and sound produce is not too noisy to listen too. Changes are make if found any unsuitable sound to a more suitable and pleasing sound.

6.5.2 Types Of Integration

There are few approaches for merging components to test the system.

6.5.2.1 Bottom-up Integration

Bottom-up integration is one of the popular approaches for merging components to test the larger system.

Interactive Multimedia Learning Science with Puzzle also used this approach to test the system. Each component at the lower level of the system hierarchy is tested individually first. Then, the next components to be tested are those that call the previously tested ones. This approach is followed repeatedly until components are included in its testing.

The bottom-up method is useful when many of the low-level components are general-purpose utility routines that are invoked often by others, when the design is object-oriented or when the system is integrating a large number of stand-alone reused components (Pfleeger, 1998).

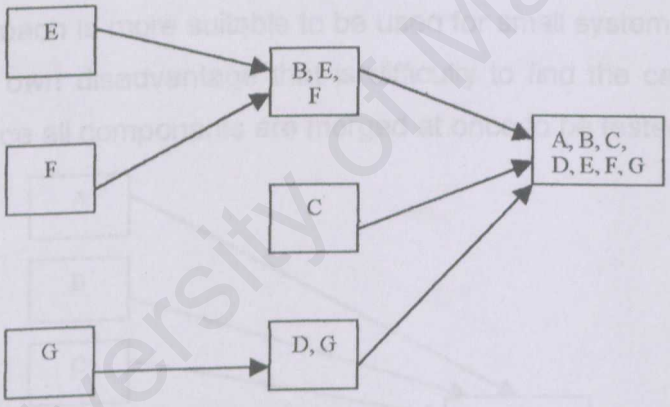


Figure 6.1: Bottom-up Testing

6.5.2.2 Top-down Integration

Top-down approach is the reverse way of bottom-up approach. The top-level, usually one controlling component, is tested by itself. Then, all components called by the tested component(s) are combined and tested as a lager unit. This approach is reapplied until all components are incorporated (Pfleeger, 1998).

In this program, the testing is done from a component, the component may call another sub-component that may have not been tested. This will ensure that all of the low-level components will be tested and it can work appropriately and different calling to the componenets.

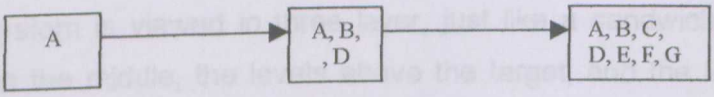


Figure 6.2: Top-down Integration

6.5.2.3 Big-bang Integration

The big-bang testing approach is used when all components are tested in isolation. It is tempting to mix them together as the final system and see if it works the first time.

This approach is more suitable to be used for small system. However, it has its own disadvantage that is difficulty to find the cause of any failure since all components are merged at once to be tested.

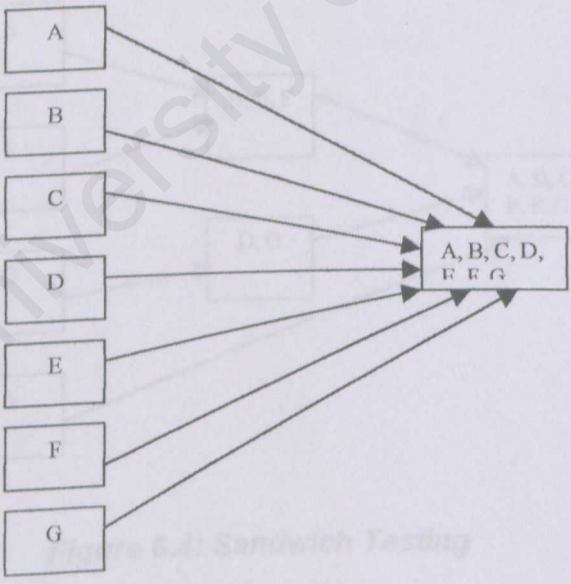


Figure 6.3: Big-Bang Testing

6.5.2.4 Sandwich Integration

A sandwich testing approach is basically the combination of the top-down strategy with a bottom-up strategy into one.

The system is viewed in three layer, just like a sandwich: the target layer in the middle, the levels above the target, and the levels below the target. Testing converges on the target layer, chosen on the basis of system characteristics and the structure of the component hierarchy (Pfleeger, 1998).

Using sandwich testing approach allows integration testing to begin in the testing process. Since this strategy is the combination of two different strategies, it holds the advantage of top-down with the bottom-up by testing control and utilities from the very beginning. On the other hand, it does not test the individual components thoroughly before integration.

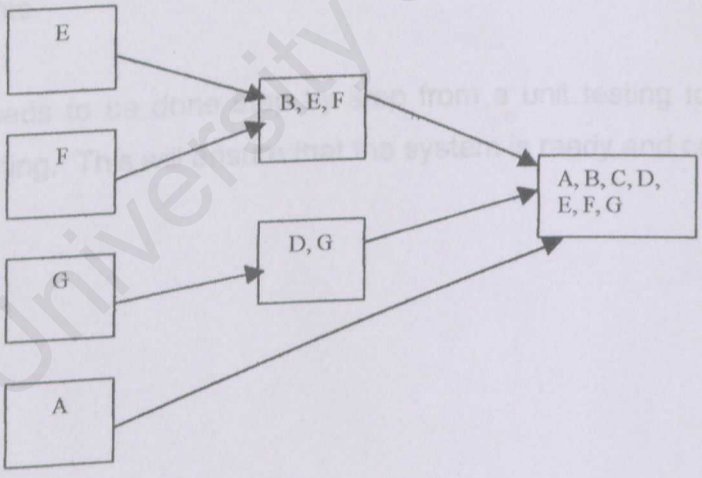


Figure 6.4: Sandwich Testing

6.6 Acceptance Testing

This is the final stage in the testing process before the system is accepted for operational use. The system is tested with data supplied by the system procurer rather than simulated test data. Acceptance testing may reveal errors and omissions in the systems requirements definition because real data exercises the system in different ways from the test data. Acceptance testing may also reveal requirements problems where the system's facilities do not really meet the user's needs or the system performance is unacceptable.

6.7 Conclusion

Testing is definitely a crucial phase, as it will determine the real performance of the system. If there is no testing been done, we cannot be sure that the system is run with error free or according to the requirements.

Testing needs to be done step by step from a unit testing to the whole system testing. This will ensure that the system is ready and competed.

CHAPTER 7: EVALUATION

CHAPTER 7: Evaluation

7.1 Introduction

After the system implementation of the Interactive Multimedia Learning Science with Puzzles, the end product of the project is brought up for evaluation. There are many techniques which will be use to evaluate the final system.

In this chapter, it will discuss challenges that faced throughout the entire development of the system. The strength and limitation of this system is being evaluated as well. Future enhancement is included to better improve the existing system.

7.2 Knowledge Gained

During the entire development and design of Interactive Multimedia Learning Science With Puzzles, experiences and knowledge gained. The following are some of the knowledge that I have gained from the project: -

7.2.1 Create Animation

Learned how to create graphics. Each piece of the graphics are then combine together into a movie clip to create a creative animation graphics. I learned how to be creative and be innovative in designing and drawing the graphics.

7.2.2 Drawing Graphics Using Computer

It is my first experience to draw graphics using computer. It is quite challenging, as I really need to know how to control the mouse so that the pencil tool can draw graphics under my hand control. Before starting

drawing, a draft must is drawn on a piece of paper to get the idea how to transfer the graphics to computer drawing.

7.2.3 Capabilities Of Adobe Photoshop In Editing Graphics

Have learned that Photoshop is not only used to import graphics from scanner but also can do marvelous editing unto it. The graphic can just the color or create a new color to it, and making any tonal adjustment where necessary can be done.

Adding some effect unto the graphics can really make the pictures more pleasant to look at with different kind of filter.

7.3 Challenges And Solution

Throughout the development of this system, I had faced some challenges.

7.3.1 Choosing The Development Technologies, Authoring Tools & Programming Tools

Due to my lack experience in understanding and knowledge on developing a multimedia educational package, I faced challenges in choosing the right tools to use. Since, multimedia educational package is getting more common in other country and is a new technology approach, there are many authoring tools and programming tools available in the market. Choosing appropriate authoring tools and programming tools is a critical process as every tools has its own strength and limitation.

7.3.2 Determining The Scope Of System To Be Built

It is far impossible to develop a full-scale complete system for young age students in learning science due to the time constraint given. Therefore, it is needed to determine the subjects and categories to be put into the system.

7.3.3 Time Constraint

7.3.3.1 Learning ActionScript

This system is to be developed in a semester time. It is really a scratch to create animated graphics and drawing graphics using authoring tools then drawing them free-hand on a piece of paper. Time of learning really required to be familiar with the tools.

Flash is really new to me as I have never learned any multimedia software before. Tutorials from internet and as well from books is referred to have a better understanding in using ActionScript. Exercises were done to increase my knowledge and understanding in using ActionScript.

7.3.3.2 Learning Drawing And Edit Graphics

It requires a lot of practice to play around with the mouse to draw graphics using Adobe Illustrator. Examples of graphics are observed how it was drawn.

7.4 System Strength

The following points illustrate the strengths of the system.

7.4.1 User-Friendly Interface

Interactive Multimedia Learning Science With Puzzles is user-friendly and consistent environment, with a standard design such as buttons are given. Hence, it requires no memorizing of commands. This will enable the children to play around without much problem occurred.

7.4.2 According To The KBSR Syllabus

The objective of this courseware is to prepare the lower primary students to study science in upper primary level. The lessons and questions ask is very in line with the KBSR syllabus to ensure that the children understand what they learn. Besides, the main target is for Malaysia students, therefore, the language that is used is Bahasa Malaysia.

7.4.3 Colorful And Attractive Graphical User Interface (GUI)

This courseware applies a user friendly concept by portraying the various true color images and enhanced graphics. Besides that, soft color of proper contrast increase the mental alertness and the level of understanding.

7.4.4 Interactive

The puzzles, games and lessons modules in the courseware provides the users with the means to help the students to absorb knowledge and test their knowledge in various categories.

7.4.5 Self Pacing & Timeliness

Computers are always ever ready where the user is. This will encourage the children to be self-learning or independent learning.

Besides, students can progress through the lessons at their own pace. Students can learn according to their mental ability, review difficult section and even request additional practice whenever they want. Nowadays, students are very motivated and personally involved.

7.4.6 Multimedia Elements

Since this package is in multimedia approach, there are animation images, graphics and suitable sound provided. Most of the scenes are prepared

completed with all these multimedia elements. The aim is to attract the users' attraction and concentration compare with just reading the book.

To enable the users' differentiate between buttons and graphics, buttons effect are provided as well. The button effect will alert the users that the particular graphics is a button and will link the users to another scene.

7.5 System Limitation

Owing to time constraints, they are certain limitation which are sighted and noticed being test by end-user.

7.5.1 Sound

In this courseware, the user can only read the notes and questions by themselves. The user cannot select either the notes or questions are to be read to the user or not.

7.5.2 Limited Interaction

The user cannot have full interaction in this courseware. There are only certain interactions available for the user available. This will limit the user interact while using it.

7.5.3 Static Questions

At the moment now, this courseware cannot set random questions to be asked to the students. Same questions will be asked to the students for every category.

7.5.4 One Game Available

There is only one game available for the children to play. This might bored the students with the same game.

7.6 Future Enhancement

Some functionality of the system can be enhanced in order to improve the quality of the system

7.6.1 Sound Reading And Voice

It good to have the option whether the notes and questions should be read out to user according to the user's wish. Voice of mistakes and wrongs can be added in especially the puzzles modules to enhance the memory of the students in understanding.

Besides, sound can also be added when the user click on certain graphics to make learning session more fun and enjoyable.

7.6.2 Increase The Level Of Interactive

There should be interactive in this courseware to make learning more fun. Clicking on certain graphics will produce animal sound. Allowing them to ask certain doubts and questions can be provided. More interactive sample can be provided.

7.6.3 Random Set Questions

The questions that are set is static and not randomly choose. Therefore, random questions can be added into the puzzles modules. This will help the user to have variety sets of questions given and different time.

7.6.4 More Puzzles And Games

As time pass by, students' will gain sufficient knowledge with the available questions. More puzzles can be developed to increase their knowledge and to extend the learning in this courseware, such as jig-saw puzzles, crosswords and so forth.

Additional puzzles games can be developed in the future will increase the zest of the user and their interest.

7.6.5 Setting Different Level For Game

Even though the words in the game are randomly choose, it is applicable if it is divided into different categories. It will help the user to think of word in that particular category and more easy to play.

7.7 Conclusion

As the interactive multimedia enters the mainstream as an educational medium, it is imperative that the students have the opportunity to expose themselves to the new technology of learning instead of reading textbooks, newspapers and reference books only. Nowadays children are very active and keen learning child. They tend to move about more rather than sitting in the class listened to the teacher. This will give the students and also the teachers a new technique of studying and teaching.

USER MANUAL

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APPENDIX A: User Manual

1. Getting Started

Interactive Multimedia Learning Science with Puzzles is a Flash Application. Just click on the executable button (*see below image*) and you will be able to enter to the system.

Science Final.exe

2. Entering The System

Figure A1: Professor Scene (a)

When the user clicked on the system application, the first scene that the user will see is the above scene. This scene is the starting scene before user start to explore and play around. Underneath the professor and the cat there a 'click me' word (*box in red*) which will require user to click on the professor to enter to the main menu of the system.

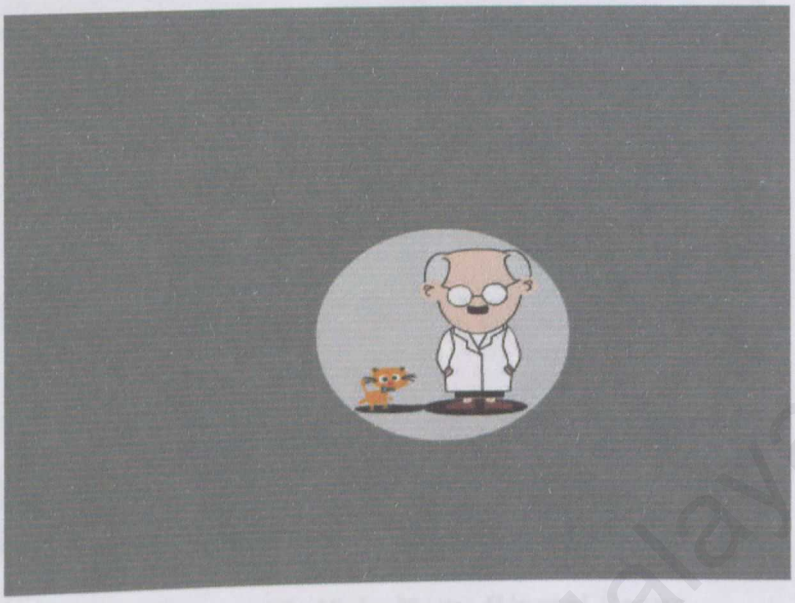

Figure A2: Professor Scene (b)

When the user put the mouse is over the professor and the cat, both professor and the cat will 'look' at the user. After clicking, user is now in a new scene that is the main menu scene (home scene).

3. Main Menu (Home)

The main menu for this system is in this scene. All three main module will be put in this scene - lesson module, puzzles module and game module. The user just has to choose either one of the 'windows' of the house to link user to the new scene.

Figure A3: Main Menu (Home) Scene

For example, if the user wants to go to the lesson module. Once the user's mouse is over the *Pelajaran* window (*see circle in red*), the graphics will animate and the user can click on the window. As the user click on the window, the window will be open and it will link the user to the *library*.

4. The Library

When the user chose the lesson module, the first scene that the user will see is the library. If the user take a closer look, all books on the shelves are blur in color except for five books. These five books have the function as a button which will link user to the respective lesson. The books that are circle in red are the books that can link user to the respective lesson.

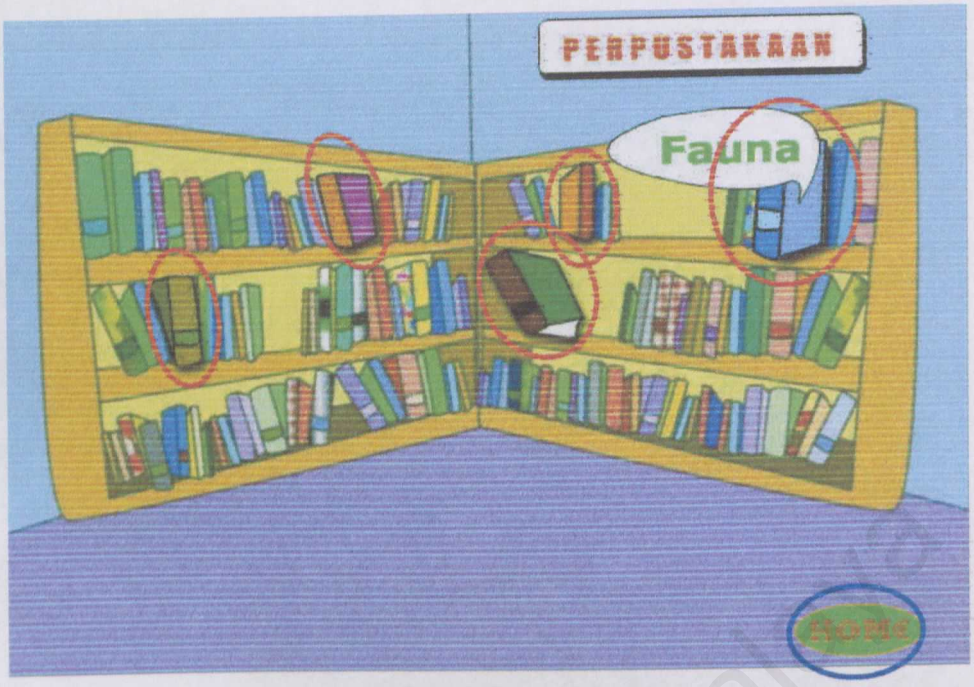

Figure A4: Library Scene

When the user's mouse is over any of the books, the size of the books will enlarge and a text representing the book title. The below example is the selection book for *fauna* (animal). After clicking on the book it will link user to the lesson on *fauna*.

If the user accidentally or wish to return to the main menu, user can click on the home button (*see color in blue*).

5. Lesson's Scene

Every scene in the lessons have three main buttons – back, next, and menu buttons. The back and next button allowed the user to go back and nest scene as the user like. As for the menu button, once the user click on it, it will link back the user to the library scene.

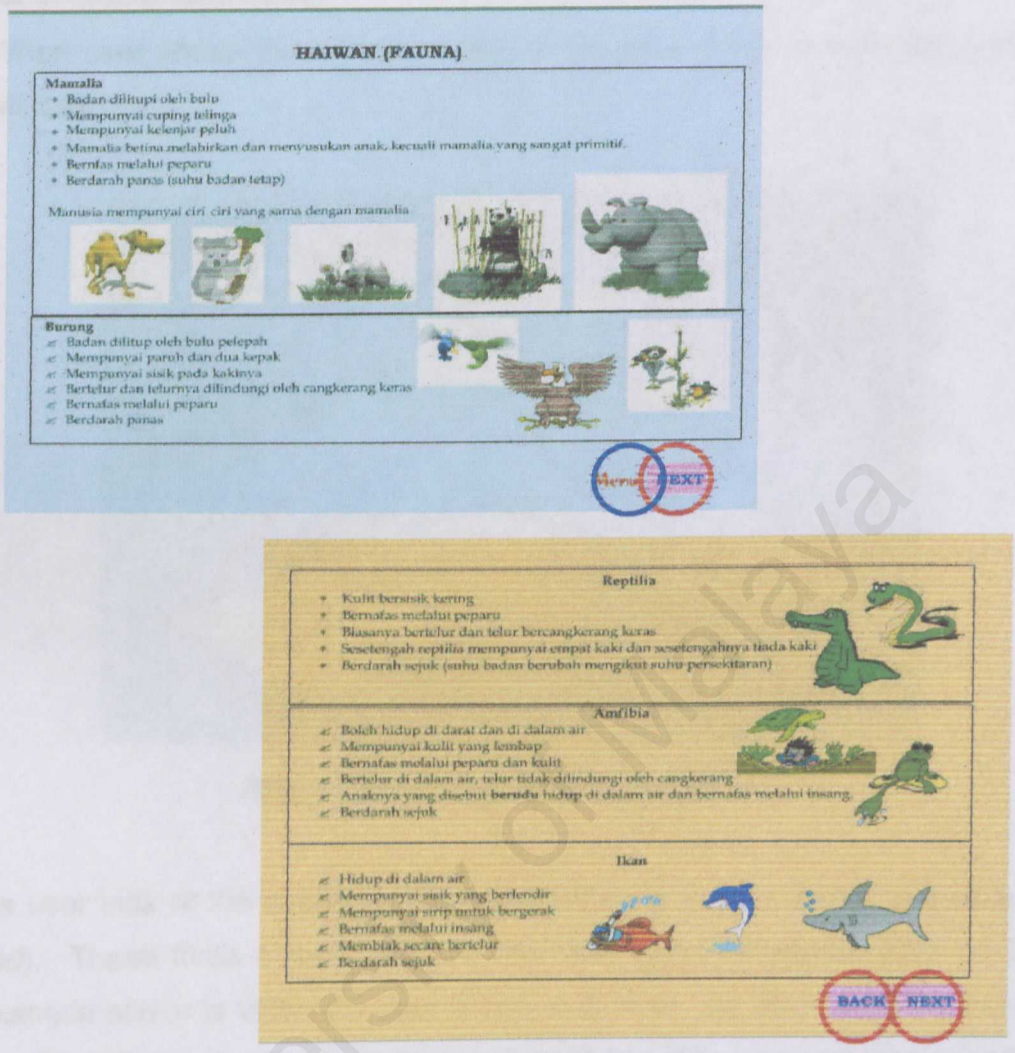

***Figure A5:* Lesson Module Scene**

The menu button (*see circle in blue*) exist only on the first page and the last page of every category lesson. Therefore only, either the first page or the last page of a lesson is able to have the function button to link user back to the library. As for the other scenes in the lesson, it only has the buttons for back and next action (*see circle in red*).

6. The Study's Room

When user chose the puzzle window in the main menu, the following scene will be shown.

Figure A6: Study's Room Scene

As user look at the scene, only three objects are clear colored (*see circle in red*). These three objects later will link user to the respective puzzle. The example above is when the user chose to click on the blackboard (*see circle in red*). Whenever the user's mouse is over any of these three objects, a text for the puzzle will be shown.

If the user accidentally or wish to go back to the main menu, user can click on the home button (*see circle in blue)*

7. Puzzle Scene

The following are the menu for each of the puzzles session.

Figure A7: Puzzle Scene (a)

Each graphics that have a text with it is button that will link user to the puzzles session (*see circle in red*). The category of the questions that will be asked is according to the text name.

However, if the user want to return to the study's room, user can click on the menu button (*see circle in blue*).

***Figure A8*: Puzzle Scene (b)**

Every graphics that have a text – '*klik saya*' is an active button (*see circle in red*). Clicking on the graphic with the button function will link user to different set of word search.

However, if the user decided to return to the study's room, user can click on the menu button (*see circle in blue*).

7.1 Question Scene

The buttons for the objective question and fill in the blank have the similar function. An example will be shown below how to play with all the buttons available in this session.

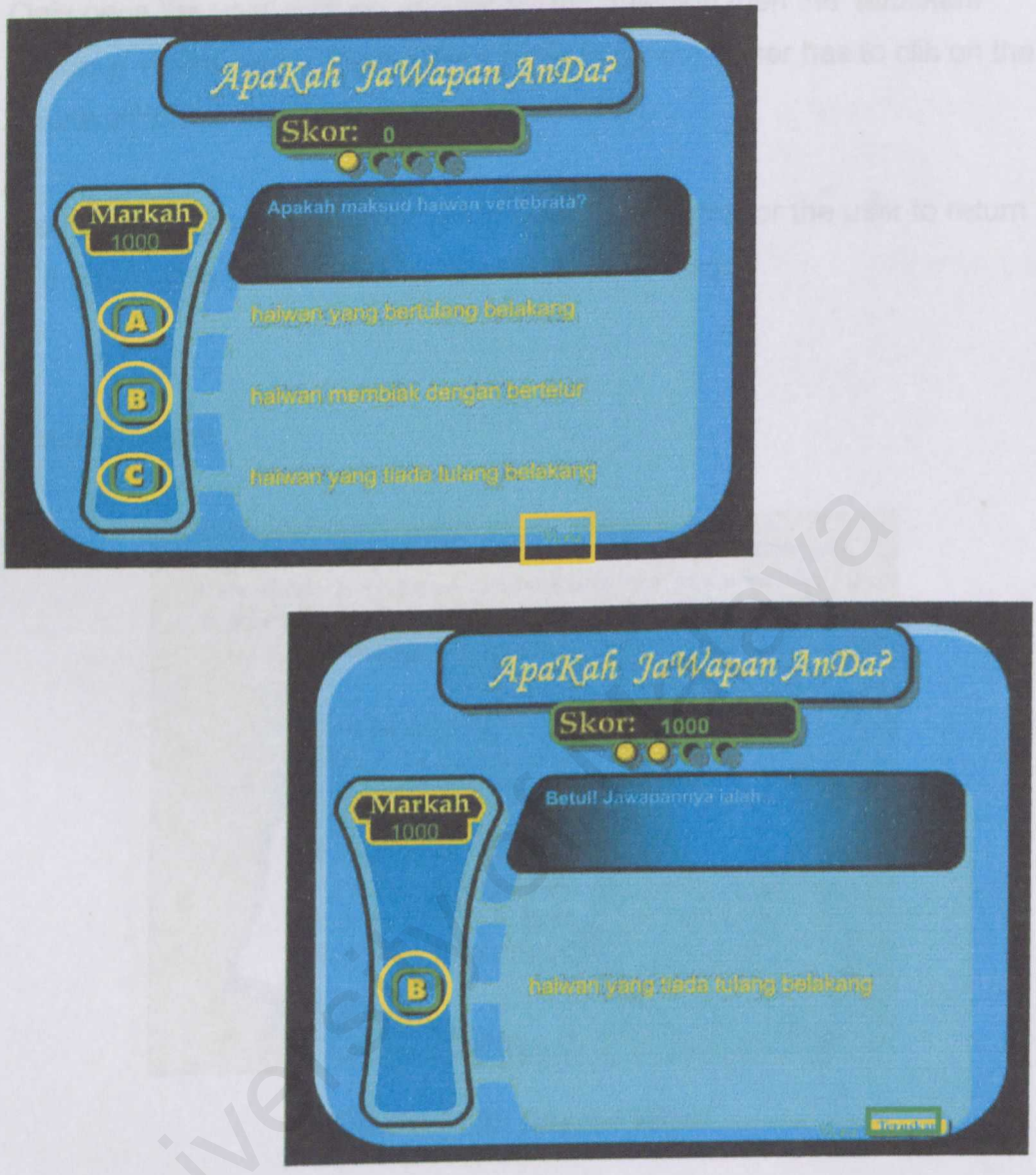

Figure A9: Question

There are three buttons for answer – A, B, C (*see circle in red*). User can only click one of the buttons as the answer for the question in question's box. Let say, user click B button, the other two buttons will be invisible after clicking the B button.

Only once the user click an answer for the question then the '*teruskan*' button is visible and activated (*see circle in green*). User has to clik on the '*teruskan*' button to continue the next question.

Menu button (*see circle in yellow*) is always available for the user to return to the following puzzle menu (*objective or fill-in menu*).

7.7.2 Word Search

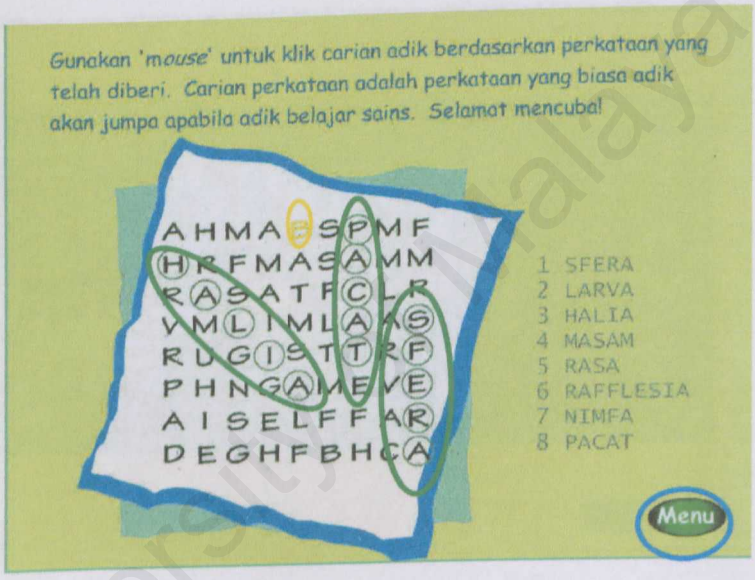

Figure A10: Search Word

Each of the letters in the search word's box is created as an individual button. When the mouse is over any of the letters, the letter color will change from black to red color (*see circle in yellow*). The above example is the letter B that changed its color from black to red color.

However, not all of the letters are activated button. Some of them when it is clicked there is no effect to it. The above example is like the word *sfera*, *halia*, and *pacat*.

Only those letters, which belongs to the search word can be clicked. A purple circle will circle the letter after it was click as a right answer (*see circle in green*).

User can return to the puzzle menu (*word search menu*) by clicking on the menu button (*see circle in blue*).

8. Game Module

Figure A11: Game Scene (a)

When user enter the game module, the first scene that user will see is 'The Bonky' scene. After user click on any part of the green background, user will have fun in guessing the word game.

If user wants to quit the game, user can just chose to click on the home button (*see circle in red*) to return to the main menu (home).

8.1 Playing The Game

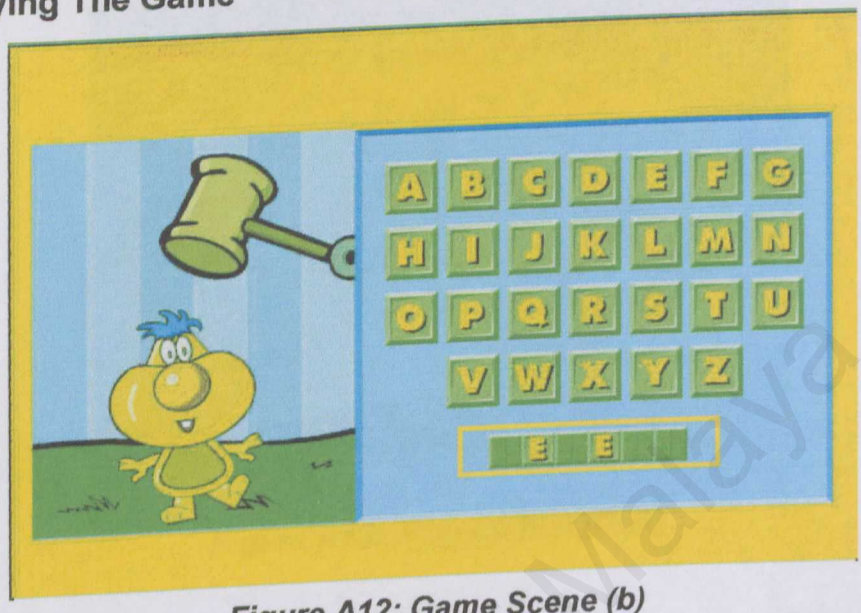

Figure A12: Game Scene (b)

User can click on any of the letters in box to guess the word. But each wrong guess word will make Bonky nervous as the wooden mallet will raise higher ready to '*bong*' Bonky. But for the right guess of letter, the letter will fill up the word guess box (*see box in red*). The above example show that the user clicked the letter 'E' is the right guess filling up the guess box.

9. Quit

When user chose to quit from the system, a pop up box will appear. The pop-up box is to confirm user that user really want to quit and not accidentally quit.

Figure A13: Pop-up box (Quit)

If the user chose *NO*, then user will return to the main menu. But, when the user clicked *YES*, the following scene will be shown. This will end user from using the system.

FigureA14: End Of The System

BLIBIOGRAPHY

BIBLIOGRAPHY

1. Kendell, K.E., & Kendell, E.J., (1998), *System Analysis Ans Design*, Prentice Hall: New Jersey.
2. Schuman, J.E., *Multimedia In Action*, Integrated Media Group.
3. Tway, L., *Multimedia In Action*, Sapphire Pacific La Jolla, CA.
4. Ackerman, P., *Developing Object-Oriented Multimedia Software*.
5. Fairley, R.E., (1985), *Software Enginerring Concepts*, McGraw-Hill: USA.
6. Hayward, S., (1984), *Computers For Animation*, Focal Press: England
7. England, E., & Finney, A., (1999), *Managing Multimedia: Project Management For Interactive Media*, Addison-Wesley: Great Britain.
8. Fuori, W.M., & Gioia, L.V., (1993), *Computers And information Processing*, Prentice Hall:Singapore.
9. Lemay, L., & Perkins, C.L., (1996), *Teach Yourself JAVA for Macintosh in 21 Days*, Macmillan Company Publishing: USA.
10. Heitel, H.M., & Deitel, P.J., (1999), *JAVA How to Program*, Prentice Hall: New Jersey.
11. Vilamil-Casanova, J., & Louis, M., (1996), *An Interactive Guide to Multimedia*, Macmillan Company Publishing: Indiana Polis
12. Pilgrim, A., (1994), *Build Your Own Multimedia PC*, McGraw-Hill: USA.
13. Levin, C., (28 Sept, 1993), *Multimedia Tools for Teaching*, PC Magazine.
14. Livingston, Dan, (2001), *Advanced Flash 5 ActionScript in Action*, Prentice Hall: New Jersey.
15. Jamalludin Harun, Zaidatun Tasir, (2001), *Macromedia Flash 5-Garfik Dan Animasi Digital Siri II*, Venton Publishing: Kuala Lumpur.

WEB SITES

1. http://www.macromedia.com
2. http://www.thomson/wadsworth/schuman
3. http://www.iste.org/publishing/jrce/vol128/issue3.html
4. www.mindspark.com.my
5. www.bonzi.com
6. http://www.crpuzzles.com
7. http://www.cut-the-knot.com/content.html
8. www.dk.com
9. www.e-b-k.com/index.htm
10. http://sin.fi.edu/tfi/units/life
11. http://www.school.discovery.com